

TOSHIBA

AUDIO DIGITAL IC'S

Preliminary
Additional Version

March. 1990

TOSHIBA CORPORATION

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DTS Series Application List

For Car Audio-1 (DTS-9/10)

SYSTEM NO.	SYSTEM LSI	SUITABLE PRESCALER /PLL	OPERATING VOL-TAGE	CRY-STAL	RECEIVING BAND				PRESET MEMORY	TUNING MODE				CLOCK FUNCTION			DISPLAY	FUNCTION SWITCH	OTHERS
					FM	MW	LW	SWTV		MAN-UAL	SEEK	SCAN	MEM-ORY SCAN	CLOCK	TIMER	SLEEP			
DTS-9	TC9302 AF	TC9172AP	4.5 ~ 5.5V	7.2 MHz	○	○	○	—	FM:6 MW:6 LW:6	○	△ UP only	△ UP only	○	12H / 24H	—	—	LCD •5V Use •1/2 Duty 1/2 Bias •54 Segments	3+*(3) *(3) is at tape mode	•Tape deck function •-009:Auto search mode is stopped by stop signal even if SCAN Key is kept to push. •-001A/-009:Band range MW= 531~1602KHz •-022:Band range MW= 522~1611KHz
	TC9302 AF-010				○	○	○	—		○	△ UP only	△ UP only	○	24H	—	—		↑	•An Europe exclusive use •Tape deck function •25K/50KHz step at FM band •IF 450K/468KHz at AM band
	TC9303 AN-009				○	○	○	—		○	△ UP only	△ UP only	○	12H / 24H	—	—	VFD •Dynamic display •7 digits x 8 Segments	2	•Tape deck function •Clock disable •External display of memory CH by TC9174P.
DTS-10	TC9304 F-002	Built-in	4.5 ~ 5.5V	7.2 MHz	○	○	○	—	FM:18max. MW:12max. LW: 6max. Total 24 stations	○	○	—	○	12H	—	—	LCD •5V Use •1/2 Duty 1/2 Bias •50 Segments	4 at tape mode	•Tape deck function •SDK function •Clock disable
	TC9304 F-003				○	○	○	—		○	△ UP only	△ UP only	○	12H	—	—		↑	•Tape deck function •Clock disable
	TC9304 F-011				○	○	○	—	FM:12max. MW: 6 LW: 6 Total 24 stations	○	○	○	—	12H / 24H	—	—		—	•SDK function •IF-Count Auto-Stop •Clock disable

For Car Audio-2 (DTS-10)

SYSTEM NO.	SYSTEM LSI	SUITABLE PRESCALER /PLL	OPERATING VOLTAGE	CRYSTAL	RECEIVING BAND			PRESET MEMORY	TUNING MODE				CLOCK FUNCTION			DISPLAY	FUNCTION SWITCH	OTHERS	
					FM	MW	LW		SW/TV	MANUAL	SEEK	SCAN	MEMORY SCAN	AUTO MEMORY	CLOCK				TIMER
DTS-10	TC9304 F-012/ *-047/ *-051	Built-in	4.5 ~ 5.5V	7.2 MHz	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	12H	-	-	LCD .5V Use .1/2 Duty 1/2 Bias .50 Segments	1+4 at tape mode	.Tape deck function .Clock disable .Clock display is optional in radio off. .MW(USA) Band range -012:530~1620KHz -047&-051:530~1710KHz --051:Auto tuning step (9N/9+2) can be selected by operation in LW band.	
					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	12H	-	-		4 at tape made
	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	12H / 24H	-	-		↑	↑
	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	12H / 24H	-	-	LCD .5V Use .1/2 Duty .1/2 Bias .64 Segments	6	.Tape deck function .SDK function .Volume control .Detecting the Field strength of a signal .Clock disable .IF Count Auto-Stop
	** TC9309 F-001				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	12H / 24H	-	-		6	.Tape deck function .Clock disable .Volume control .IF count Auto stop .Detecting the Field Strength of a signal	
	** TC9309 F-002				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	12H / 24H	-	-		6		

* : New products
** : Under development

For Radio Cassette & Head-Phone Stereo (DTS-9/11/12)

SYSTEM NO.	SYSTEM LSI	SUITABLE PRESCALER /PLL	OPERATING VOL-TAGE	CRY-STAL	RECEIVING BAND				PRESET MEMORY	TUNING MODE				CLOCK FUNCTION			DISPLAY	FUNCTION SWITCH	OTHERS
					FM	MW	LW	SW		TV	MAN-UAL	SEEK	SCAN	MEM-ORY SCAN	CLOCK	TIM-ER			
DTS-9	TC9302 AF-008	TC9172AP	4.5 ~ 5.5V	7.2 MHz	○	○	○	○	—	FM :5 MW :5 LW/SW:5 MF+MW+ LW/SW:10	○	○	—	○	—	—	LCD .5V Use .1/2 Duty 1/2 Bias .54 Segments	2	•FM/MW/LW or FM/MW/SW1/SW2 bands are available. •Signal level display •External memory CH display by TC9174P.
	TC9302 AF-027	TC9227P			○	○	○	○	—	FM:5 MW:5 LW:5 SW:5	○	△ UP only	—	—	—	—	Segments	2	•IF-Count Auto-stop •Signal level display •Beep sound output •SW meter band tuning
DTS-11	TC9308 AF-005 /-022*	TD6134AF	1.8 ~ 3.6V	75 KHz	○	○	—	○	VHF	FM:5 MW:5 TV:5 FM+MW:10	○	○	△ UP only	—	12H / 24H	60 Minutes (JAPAN only)	LCD .3V Use .1/2 Duty 1/2 Bias .40 Segments	—	•LOW voltage operation •Beep sound/Alarm function •Semi-Auto memory function •IF-Count Auto-stop in combination with TA8132AF. •MW(USA) Band range -005:530~1610KHz -022:530~1710KHz
	TC9307 AF-004 /-007*	TD6135P (at TV band)	4.5 ~ 5.5V	75 KHz	○	○	○	○	VHF / UHF	FM:10max. MW:10max. SW:5+5 LW:5 TV:7+7 Total 28 Stations	○	△ UP only	△ UP only	○	12H / 24H	1 Minutes	LCD .3V Use .1/4 Duty .1/3 Bias .48 Segments max.	—	•IF-Count Auto-stop •Clock disable •Semi-Auto memory function •SW meter band tuning •MW(USA) Band range -004:530~1610KHz -007:530~1710KHz
DTS-12	TC9307 * AF-008	TD6135P (at TV band)			○	○	○	○	VHF / UHF	FM:10max. MW:10max. SW:5+5 LW:5 TV:7+7 Total 28 Stations	○	△ UP only	△ UP only	○	12H / 24H	1 Minutes	LCD .3V Use .1/4 Duty .1/3 Bias .48 Segments	—	•IF count Auto Auto stop •Clock disable. •FM wide Band •The Band is changed to cyclic by one key

* : New Products

For Hi-Fi Stereo (DTS-9/10)

SYSTEM NO.	SYSTEM LSI	SUITABLE PRESCALER /PLL	OPERATING VOLTAGE	CRYSTAL	RECEIVING BAND			PRESET MEMORY	TUNING MODE				CLOCK FUNCTION			DISPLAY	FUNCTION SWITCH	OTHERS	
					FM	MW	LW		SW	TV	MANUAL	SEEK	SCAN	MEMORY SCAN	CLOCK				TIMER
DTS-9	TC9301 AN-003	TC9227P/TC9172AP and TD6105AP (at TV band)	4.5 ~ 5.5V	7.2 MHz	○	○	○	○	○	○	○	○	○	12H / 24H	1	60 Minutes	VFD	1	•Power output control •Auto function output •IF-Count Auto-stop in combination with TC9227P.
					○	○	○	○	○	○	○	○	○	12H / 24H	1	60 Minutes	○	•Power output control •Auto function output •IF-Count Auto-stop in combination with TC9227P. •Clock disable •Simulcast function in combination with TD6352P.	
					○	○	○	○	○	○	○	○	○	12H / 24H	1	60 Minutes	○	•FM/MW/LW or FM/MW/SW1/SW2 bands are available. •Signal level display •External display of memory CH by TC9174P.	
					○	○	○	○	○	○	○	○	○	12H / 24H	1	60 Minutes	○	•IF-Count Auto-stop •Signal level display •Beep sound output •SW meter band tuning	
DTS-10	TC9302 AF-027	TC9227P	4.5 ~ 5.5V	7.2 MHz	○	○	○	○	○	○	○	○	○	12H / 24H	1	60 Minutes	VFD	4	•IF-Count Auto-stop with TC9227P. •6-bit Parallel Remo-Con with TC9173P. •External display of memory CH by TC9174P.
					○	○	○	○	○	○	○	○	○	12H / 24H	1	60 Minutes	○	•IF-Count Auto-stop •STEREO/MONO display	
					○	○	○	○	○	○	○	○	○	12H / 24H	1	60 Minutes	○	•Input selector •Volume control •Remort control function •IF-count Auto-Stop	
					○	○	○	○	○	○	○	○	○	12H / 24H	1	60 Minutes	○		

** Under development

STANDARD LCD FOR TOSHIBA STANDARD DTS LSI PRODUCTS

DTS LSI Product Model No.	Applicable LCD Model No.	View Size (mm)	Driving Condition	Note
TC9302AF-001A -009 -022	E-7030-5	58×10	5V 1/2 duty, 1/2 bias	—
TC9302AF-027	E-9481	59×15		
TC9304F -002 -015	E-6089	48×11.5		
TC9304F -003	E-5066	48×11.5		
TC9304F -011	E-6102	48×11.5		—
TC9304F -012 -047 -051	E-5067	48×11.5		
TC9304F -016	E-6140	48×11.5		Only for Application of 24H Clock
TC9304F -027	E-5068	66×16		—
TC9307AF-004 -007 -008	E-9478	59×15	3V 1/4 duty, 1/3 bias	For Application of FM/AM, FM/AM/TV Band (12H Clock)
	E-0909	71×19		
	E-9479	59×15		For Application of FM/MW/SW/LW Band (24H Clock)
	E-0910	71×19		
TC9308AF-005 -022	E-9473	41.1×12	3V 1/2 duty, 1/2 bias	—
TC9309F -001	E-6185	68×15	5V 1/2 duty, 1/2 bias	
TC9309F -002	E-6187	68×15		—
TC9309F -006	E-6188	68×15		

Note) Above mentioned standard LCDs are produced by EPSON CO., LTD..

TENTATIVE

○OUTLINE OF SYSTEM

TC9304F-047 is a single chip digital tuning system for car audio use. Having the capability corresponding to the requirement of the whole world with the abundant specification selecting jumpers, this system is provided with the functions for two bands or three bands, clock and tape.

○RECEIVING BAND

BAND	AREA		RECEIVING BAND [Hz]	STEP [Hz]		Fref[Hz]	IF[Hz]	REMARK
	E1	E0		MANUAL	AUTO			
FM	0	0	87.50 ~ 108.00 M	50k	50k	25k	+10.7M	—
	0	1	87.5 ~ 107.9 M	200k	200k		-10.7M	
	1	0	76.1 ~ 89.9 M	100k	100k			
	1	1	87.50 ~ 108.00 M	50k	50k			
MW	0	0	531 ~ 1602 k	9k	9k	9k	+450k	—
	0	1	530 ~ 1710 k	10k	10k	10k		
	1	0	522 ~ 1629 k	9k	9k	9k		
	1	1	531 ~ 1602 k	9k	9k	9k		
LW	0	0	153/155 ~ 281 k	1k	9k	1k	+450k	*

* MW and LW are operating as one band.

UP ----- LW 281kHz → MW 531kHz ----> MW 1602kHz → LW 155kHz ---
 DOWN ---- MW 1602kHz ← LW 153kHz <---- LW 281kHz ← MW 531kHz ---

○OUTLINE OF FUNCTION

○TUNING FUNCTION (Scan method : saw-tooth waveform type)

- Manual UP/DOWN tuning
- Auto-search tuning (SEEK)
- Hold-search tuning (SCAN)
- Memory scan tuning

○MEMORY FUNCTION

- Each band (FM1, FM2, MW/LW) : 6 stations, 3 bands×6 stations=18 stations max.
But the receiving range of each band of FM1 and FM2 are the same.
- Auto-memory function
- Preset method can be chosen 1 key type or 6 keys type.
- Built-in tracking data

○CLOCK FUNCTION

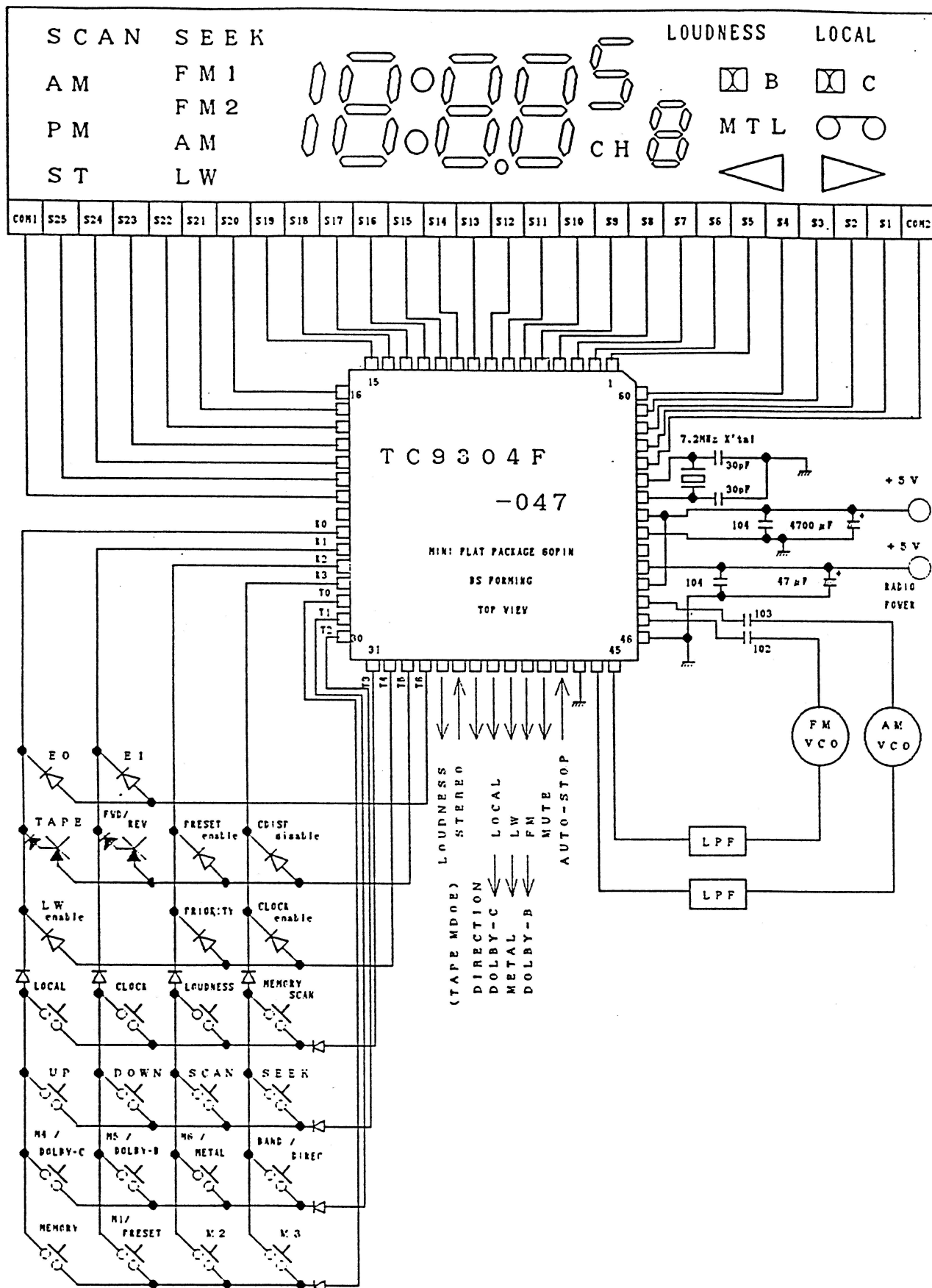
- 12/24-h clock
- Clock function is optional.
- Clock display is optional at radio off mode.

○OTHERS

The abundant function switches and display for tape deck control.

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TC9304F-051

DIGITAL · TUNING · SYSTEM

TENTATIVE

○ OUTLINE OF SYSTEM

TC9304F-051 is a single chip digital tuning system for car audio use. Having the capability corresponding to the requirement of the whole world with the abundant specification selecting jumpers, this system is provided with the functions for two bands or three bands, clock and tape.

○ RECEIVING BAND

BAND	AREA		RECEIVING BAND [Hz]	STEP		Fref [Hz]	I F [Hz]	REMARK
	E1	E0		MANUAL [Hz]	AUTO [Hz]			
FM	0	0	87.50~108.00M	50k	50k	25k	+10.7M	
	0	1	87.5 ~107.9 M	200k	200k		-10.7M	
	1	0	76.1 ~ 89.9 M	100k	100k			
	1	1	87.50~108.00M	50k	50k			
MW	0	0	531 ~ 1602 k	9k	9k	9k	+450k	
	0	1	* 530 ~ 1710 k	10k	10k	10k		
	1	0	522 ~ 1629 k	9k	9k	9k		
	1	1	531 ~ 1602 k	9k	9k	9k		
LW	0	0	* 153/155 ~ 279/281 k	1k	9k	1k	+450k	* 1

* 1 MW and LW are operating as one band. LW stop frequency is can be selected.

UP ——— LW 279/281kHz ———> MW 531 kHz ———> MW 1602 kHz ———> LW 153/155kHz ———
DOWN ——— MW 1602 kHz <—— LW 153/155kHz <—— LW 279/281kHz <—— MW 531 kHz ———

LW manual tuning : 153 ~ 281 kHz
LW auto tuning (Stop frequency 9N) : 153 ~ 279 kHz
LW auto tuning (Stop frequency 9N+2) : 155 ~ 281 kHz

○ OUTLINE OF FUNCTION

○ TUNING FUNCTION (Scan method : saw-tooth waveform type)

- Manual UP/DOWN tuning
- Auto-search tuning (SEEK)
- Hold-search tuning (SCAN)
- Memory scan tuning
- * • LW stop frequency on SEEK/SCAN selector

○ MEMORY FUNCTION

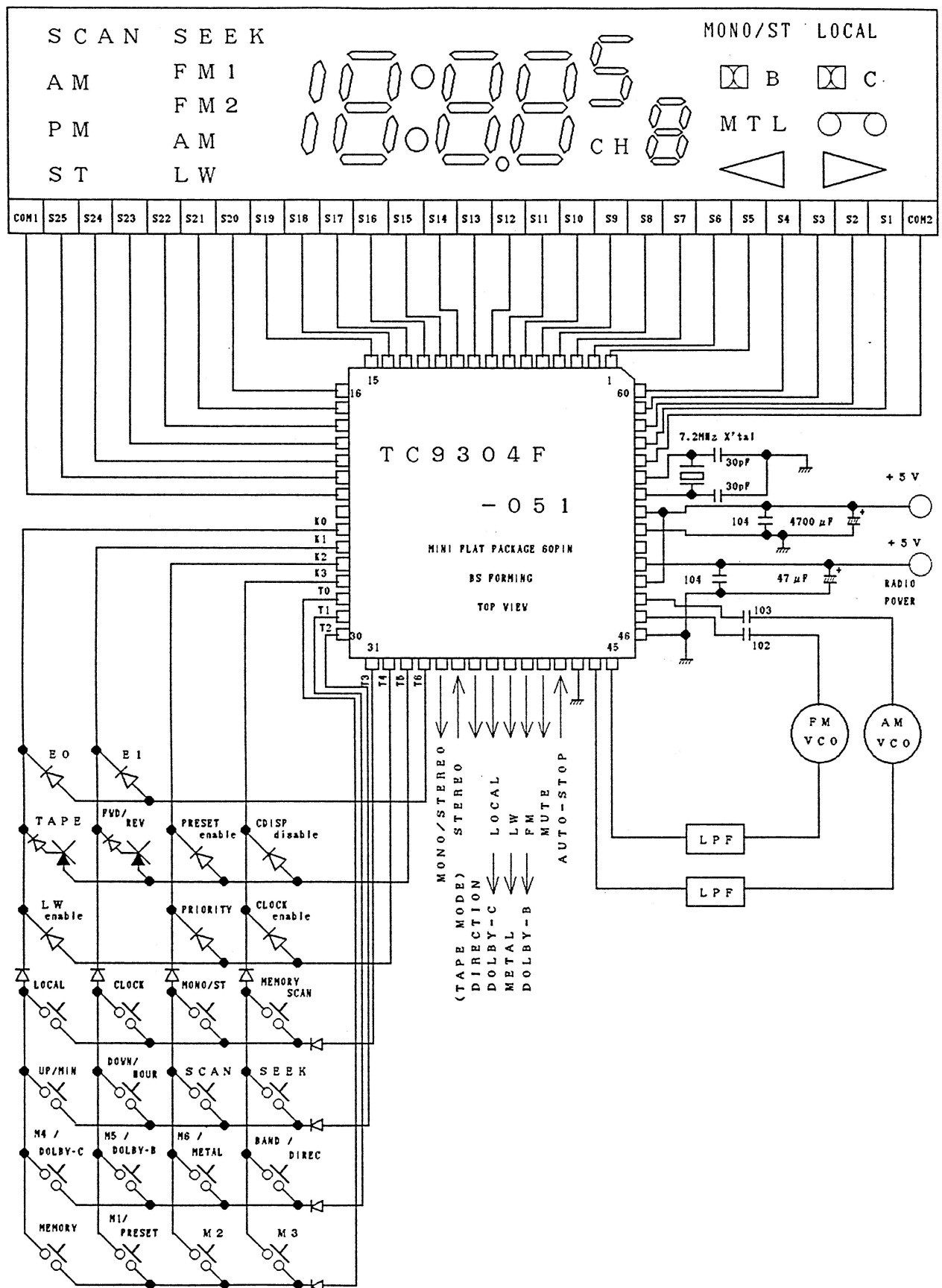
- Each band (FM1, FM2, MW/LW) : 6 stations, 3 bands × 6 stations = 18 stations MAX.
But the receiving range of each band of FM1 and FM2 are the same.
- Auto-memory function
- Preset method can be chosen 1 key type or 6 keys type.

○ OTHERS

- Clock function is optional.
- Clock display is optional at radio off mode.
- The abundant function switches and display for tape deck control.

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○ GENERAL OUTLINE OF SYSTEM

The TC9307AF-007 is a digital tuning system optimum for such portable audio equipment as radio with a cassette tape recorder, and is provided with 5 bands of TV (VHF, UHF)/FM/SW/MW/LW and compatible with worldwide destinations.

○ PRESET MEMORY FUNCTION/RECEIVING AREA

Destinations	FM	MW	TV		LW	SW			Diode		
			VHF	UHF		SW	SW 1	SW 2	E0	E1	E2
Japan	7	7	7	7	—	—	—	—			
U.S.A., California Australia	10	10	—	—	—	—	—	—			○
General (1)	10	5	—	—	5	5	—	—		○	
Middle & Near East	5	5	—	—	—	—	5	5	○		
Europe	10	5	—	—	5	—	—	—		○	○
General (2)	10	5	—	—	5	5	—	—	○		○

○ RECEIVING BANDS

○: connect diode jumper

Band	Receiving Frequency Range	IF [Hz]	Fref [Hz]	Step [Hz]	Remark
TV	1 ~ 12 CH	-10.75 M	1-3 (25k)	1 ch	JAPAN When receiving TV, Prescaler TD6135P is used.
	13 ~ 62 CH		12.5 k		
FM	76.0 ~ 90.0 MHz	-10.75 M	25 k	100 k	Others
	87.5 ~ 108.0 MHz	+10.7 M		50 k	
	87.50 ~ 108.00 MHz				
MW	531 ~ 1602 kHz	+450 k	3 k	9 k	U.S.A./California/Australia
	530 ~ 1710 kHz		5 k	10 k	
	531 ~ 1629 kHz		3 k	9 k	Japan
	531 ~ 1602 kHz		3 k	9 k	Others
	530 ~ 1610 kHz		5 k	10 k	
LW	146 ~ 281 kHz	+450 k	1 k	1 k	—
SW	5.95 ~ 15.6 MHz	+450 k	5 k	5 k	General SW-A
	3.8 ~ 12.5 MHz				General SW-B
	2.3 ~ 6.2 MHz				SW1
	7.1 ~ 21.85 MHz				SW2

○ FUNCTIONAL OUTLINE

- Tuning Function
 - Manual Up/Down Tuning (Sawtooth system)
 - Auto-up tuning (seek system) or semi-auto memory tuning is selectable.
 - IF counter system auto stop function
 - Auto tuning in SW band is the scan system in the meter band.
 - Memory scan tuning
- Clock Function
 - 12-hour/24-hour clock (set up by destination)
 - ON/OFF timer by time set system
 - Sleep timer (90 min.)

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TC9307AF-008

SIGNAL CHIP DIGITAL TUNING SYSTEM

TENTATIVE

○ GENERAL OUTLINE OF SYSTEM

The TC9307AF-008 is a digital tuning system optimum for such portable audio equipment as radio with a cassette tape recorder, and is provided with 5 bands of TV (VHF, UHF)/FM/SW/MW/LW and compatible with worldwide destinations.

○ RECEIVING BANDS

DIODE			FM	MW	TV		LW	SW			Remark
E0	E1	E2			VHF	UHF		SW	SW 1	SW 2	
			10	10	—	—	—	—	—	—	USA 1
		○	10	10	—	—	—	—	—	—	USA 2
	○		10	5	—	—	5	5	—	—	Gen. SW-A
	○	○	10	5	—	—	5	—	—	—	Europe
○			5	5	—	—	—	—	5	5	M. N. Eest
○		○	10	5	—	—	5	5	—	—	Gen. SW-B
○	○		10	10	—	—	—	—	—	—	Canada
○	○	○	7	7	7	7	—	—	—	—	Japan

○ : Diode switch is ON.

Band	Receiving Freq. Range	IF[Hz]	Fref[Hz]	step[Hz]	Reamrk
TV	1 ~ 12 CH	-10.75 M	1-3(25k)	1 ch	Japan
	13 ~ 62 CH		12.5k		
FM	76.0 ~ 90.0 MHz	-10.75 M	25 k	100 k	Japan
	87.5 ~ 107.9 MHz	+10.7 M	25. k	200 k	USA 1
	87.5 ~ 108.0 MHz			100 k	USA 2
	87.5 ~ 108.0 MHz			100 k	Other
	87.50 ~ 108.00 MHz			50 k	
MW	531 ~ 1602 kHz	+ 450 k	3 k	9 k	USA
	530 ~ 1710 kHz		5 k	10 k	
	531 ~ 1629 kHz		3 k	9 k	Japan
	531 ~ 1602 kHz		3 k	9 k	Other
	530 ~ 1610 kHz		5 k	10 k	
LW	146 ~ 281 kHz	+ 450 k	1 k	1 k	Europe
SW	5.95 ~ 15.6 MHz	+ 450 k	5 k	5 k	Gen. SW-A
	3.8 ~ 12.5 MHz				Gen. SW-B
	2.3 ~ 6.2 MHz				SW 1
	7.1 ~ 21.85 MHz				SW 2

○ FUNCTIONAL OUTLINE

○ Tuning Function

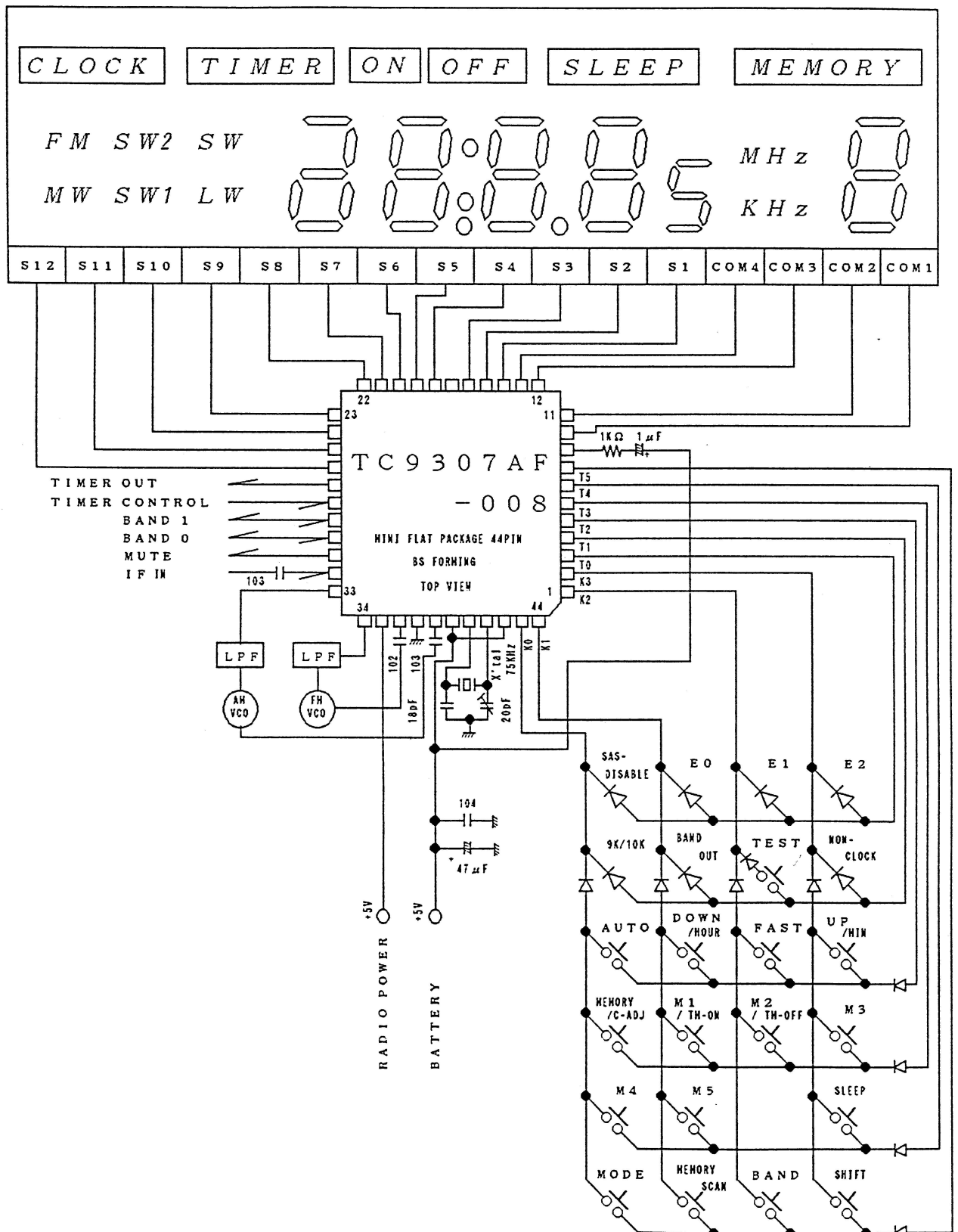
- Manual Up/Down Tuning (Sawtooth system)
- Auto-tuning (seek system) or semi-auto memory tuning is selectable.
- IF counter system auto stop function.
- Auto tuning in SW band is the scan system in the meter band.
- Memory scan tuning
- band changeover of method to which either of momentary or lock switch is selectable.

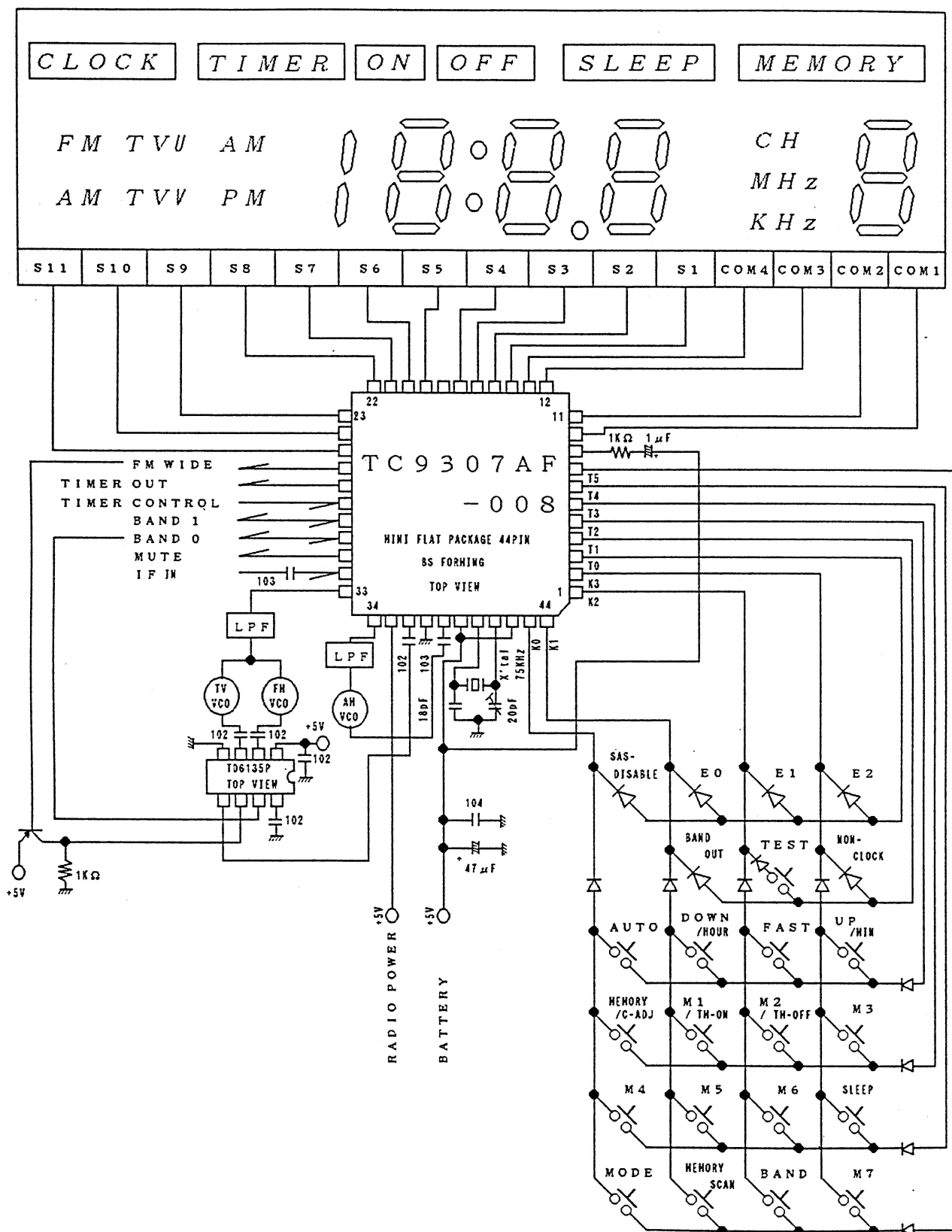
○ Clock Function

- 12-hour/24-hour clock (set up by destination)
- ON/OFF timer by time set system.
- Sleep timer (90 min.)

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○ Outline of System

The TC9308AF-022, in combination with the prescaller TD6134AF, is capable of composing a digital tuning system that is optimum to such portable equipment as pocket radio, headphone stereo and the like.

Receiving frequency bands are 3 bands of FM/AM/VHF TV for shipment to Japan and 2 bands of FM/AM for shipment to other areas than Japan.

○ Receiving Frequency Bands

Band	Area		Receiving Frequency [Hz]	Step [Hz]	Fref [Hz]	IF [Hz]
	E0	E1				
T V	0	0	Japan	4 ~ 12 ch	1 ch	6.25 k
				1 ~ 3 ch	1 ch	12.5 k
				76.0 ~ 90.0 M	100 k	-10.7 M
F M	0	1	U.S.A	87.5 ~ 108.0 M	100 k	12.5 k
	1	0	Europe 1	87.50 ~ 108.00 M	50 k	12.5 k
	1	1	Europe 2	87.50 ~ 108.00 M	50 k	12.5 k
A M	0		U.S.A	530 ~ 1710 k	10 k	5 k
			Others	530 ~ 1610 k		+450 k
	1		Japan	522 ~ 1629 k	9 k	3 k
			Others	531 ~ 1602 k		+450 k

○ Functions

- Tuning Function
 - Manual up/down tuning : 1 step/1push tuning
 - Auto tuning (seek system) : Continuous pushing the key automatically shifts to Auto Mode.
 - IF count type auto stop system in combination with the TA8132F has been adopted.
- Memory Function
 - Japan : FM/AM/TV each 5 stations
 - Overseas : FM/AM random 10 stations
 - Semi-auto memory function
- Other Functions
 - 12/24H clock
 - Alarm function
 - 60 min. sleep timer (Japanese specification only)
 - Battery charging timer function
 - Beep sound output

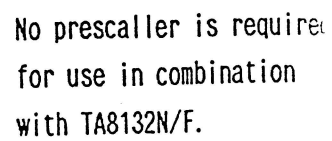
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○ Outline of System

The TC9308AF-028, in combination with the prescaler TD6134AF, is capable of composing a digital tuning system that is optimum to such portable equipment as pocket radio, headphone stereo and the like.

Receiving frequency bands are 3 bands of FM/AM/VHF TV for shipment the Japan and 2 bands of FM/AM for shipment to other areas than Japan.

○ Receiving Frequency Bands

Area		Band	Receiving Frequency [Hz]	Step [Hz]	Fref [Hz]	IF [Hz]	Memory	Clock		
E0	E1									
0	0	Japan	TV	4 ~ 12 ch	1 ch	6.25 k	-10.7 M	each 5 Station	12 H	
				1 ~ 3 ch	1 ch	12.5 k				
			FM	76.0 ~ 90.0 M	100 k					5 k 3 k
				MW	530 ~ 1610 k	10 k				
					531 ~ 1629 k	9 k				
0	1	U.S.A.	FM	87.5 ~ 108.0 M	100 k	12.5 k	+10.7 M	each 10 Station	12 H	
				MW	530 ~ 1710 k	10 k	5 k			+450 k
			531 ~ 1602 k		9 k	3 k	+450 k			
			1	0	Europe	FM	87.50 ~ 108.00 M	50 k	12.5 k	+10.7 M
MW	530 ~ 1610 k	10 k				5 k	+450 k	24 H		
	531 ~ 1602 k	9 k				3 k	+450 k			

○ Functions

- Tuning Function
 - Manual up/down tuning : 1 step/1push tuning
 - Auto tuning (seek system) : Continuous pushing the key automatically shifts to Auto Mode.
 - IF count type auto stop system in combination with the TA8132AF has been adopted.
- Memory Function
 - Japan : FM/AM/TV each 5 stations
 - Overseas : FM/AM each 10 stations
 - Semi-auto memory function
- Other Functions
 - 12/24H clock
 - Alarm function
 - 60 min. sleep timer
 - Battery charging timer function (Japanese specification only)
 - Beep sound output

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TC9308AF-028



UNDER DEVELOPMENT

○ OUTLINE OF SYSTEM

TC9309F-001 is a C-MOS LSI designed for FM/MW/LW radio of PLL frequency synthesizer system corresponded to the requirement of the whole world. Since prescaler and LCD driver are built in addition to PLL and controller, the compact FM/MW/LW digital tuning system of high performance with clock car stereo can be constructed.

○ RECEIVING BAND

AREA	CODE	BAND	RECEIVING BAND (Hz)	STEP (Hz)	STEP (Hz)	IF (Hz)
	A2A1A0					
Europe	000	FM	87.50~108.00M	50K/25K	25K	+10.70M
	or	MW	522~1620K	9K	9K	+450K /
	001	LW	153~281K	1K	1K	+459K
U.S.A. 1	010	FM	87.5~108.1M	200K	50K	+10.7M
		MW	520~1720K	10K	10K	+450K
U.S.A. 1	011	FM	87.5~108.0M	100K	50K	+10.7M
		MW	520~1720K	10K	10K	+450K
Latin America	100	FM	87.5~108.0M	100K	50K	+10.7M
		MW	520~1620K	5K	5K	+450K
Australia Middle and Near East	101	FM	87.5~108.0M	100K	50K	+10.7M
		MW	531~1602K	9K	9K	+450K
Japan	110	FM	76.0~90.0M	100K	50K	-10.7M
		MW	522~1629K	9K	9K	+450K
South America	111	FM	87.50~108.00M	50K/25K	25K	-10.70M
		MW	531~1602K	9K	9K	+450K

code="000" is 3 BAND version of Europe. code="001" is 2 BAND version of Europe.

○ OUTLINE OF FUNCTION

○ Tuning Function

- Manual tuning (UP/DOWN)
- Auto tuning (seek and scan)
- Auto memory tuning
- Preset memory scan

○ Memory Function

- FM1/FM2/FM3: max.18 stations
 - MW1/MW2/: max.12 stations
 - LW and SDK (FM): max.6 stations
 - Each band have last memory.
- max.42 stations

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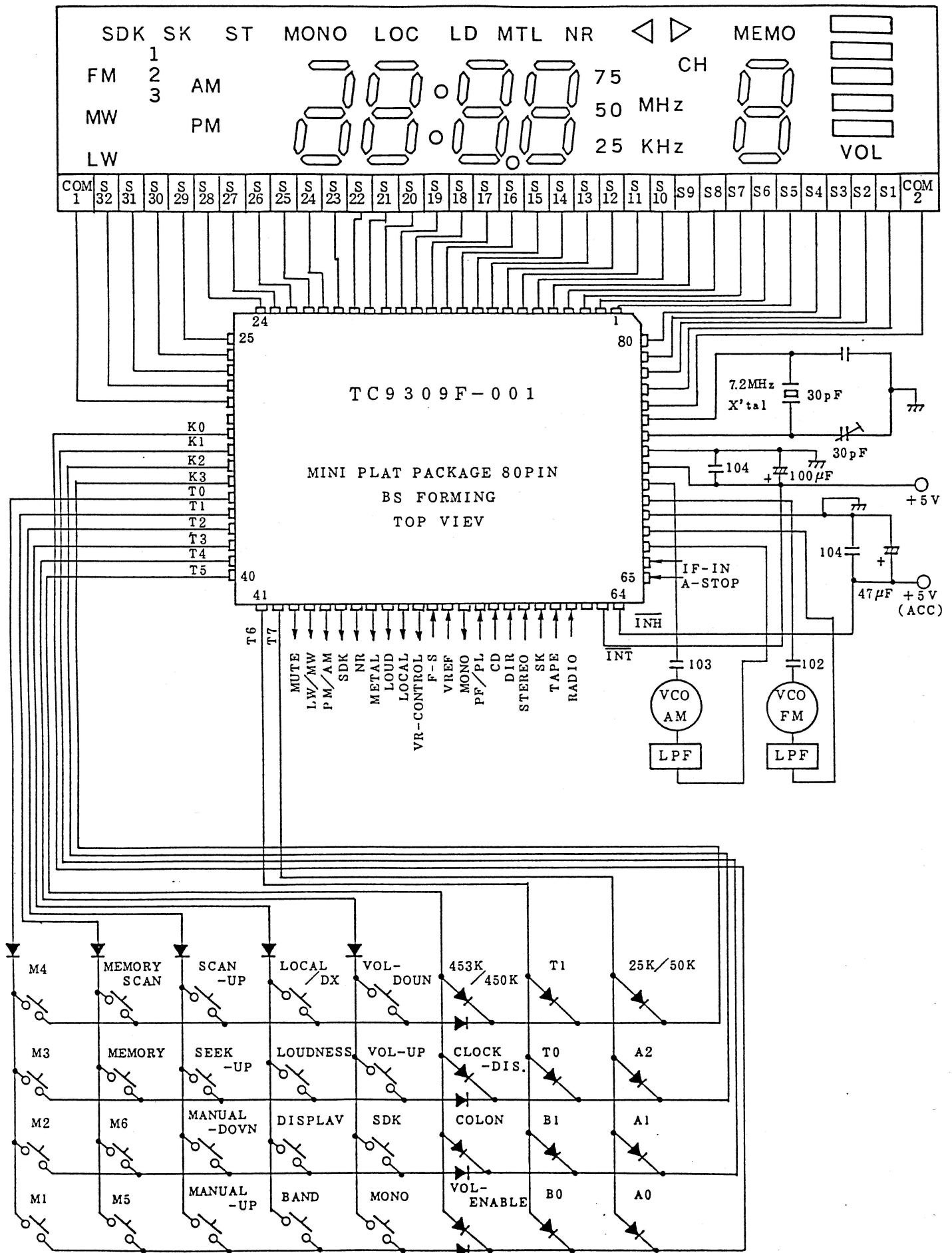
○ Clock Function

- . 24h display in EUROPE
- . 12h display in other area

○ Other Function

- . STEREO/MONO, LOCAL/DX, LOUDNESS, METAL/NORMAL, NOISE REDUCTION and the display and the control output of AUTO PROGRAM SEARCH
- . The control output and the level indicator of electronic volume
- . Tracking data

BAND	AREA	M1	M2	M3	M4	M5	UNIT
FM	Europe, South America	87.50	90.10	98.10	106.10	108.00	MHz
	U.S.A. 1	87.5	90.1	98.1	106.1	108.1	
	Australia, Latin America	87.5	90.1	98.1	106.1	108.1	
	U.S.A.2, Middle and Near East	87.5	90.1	98.1	106.1	108.1	
	Japan	76.0	80.0	83.0	86.0	90.0	
MW	Europe	522	612	999	1404	1620	MHz
	U.S.A. 1, 2	520	610	1000	1400	1720	
	Latin America	520	610	1000	1400	1620	
	Australia, South America	531	612	999	1404	1602	
	Middle and Near East	531	612	999	1404	1602	
	Japan	522	612	999	1404	1602	
LW	Europe	153	164	218	272	281	



TC9309F-002 DIGITAL TUNING SYSTEM

UNDER DEVELOPMENT

OUTLINE OF SYSTEM

TC9309F-002 is CMOS LSI developed for world-wide FM/MW/LW radio of PLL frequency synthesizer. Electronic volume function is built-in and main volume, balance, tone control (3-band type) and feder can be controlled in combination with external TC9222N/F.

RECEIVING BAND

AREA	CODE	BAND	RECEIVING FREQUENCY (Hz)	STEP (Hz)	REFERENCE FREQUENCY (Hz)	IF (Hz)
	A2A1A0					
Europe	000	FM	87.50~108.00M	50K	25K	+10.70M
	or	MW	522~1620K	9K	9K	+450K/
	001	LW	153~281K	1K	1K	+459K
USA 1	010	FM	87.5~108.1M	200K	25K	+10.7M
		MW	520~1720K	10K	10K	+450K
USA 2	011	FM	87.5~108.0M	100K	25K	+10.7M
		MW	520~1720K	10K	10K	+450K
Latin America	100	FM	87.5~108.0M	100K	25K	+10.7M
		MW	520~1620K	5K	5K	+450K
Austral, Middle & Near East	101	FM	87.5~108.0M	100K	25K	+10.7M
		MW	531~1602K	9K	9K	+450K
Japan	110	FM	76.0~90.0M	100K	25K	-10.7M
		MW	522~1629K	9K	9K	+450K
S-Africa	111	FM	87.50~108.00M	50K	25K	-10.70M
		MW	531~1602K	9K	9K	+450K

code=000 is 3 bands(FM/MW/LW), code=001 is 2 bands (FM/MW)

OUTLINE OF FUNCTION

- . Tuning Function
 - . Manual UP/DOWN tuning
 - . Auto tuning (SEEK/SCAN)
 - . Auto memory tuning
 - . Preset memory scan
- . Memory Function
 - . FM1/FM2/FM3: 18 stations (max.)
 - . MW1MW2 : 12 stations (max.)
 - . LW : 6 stations (max.)

} total 36 stations (max.)

- . Each band has last channel memory.

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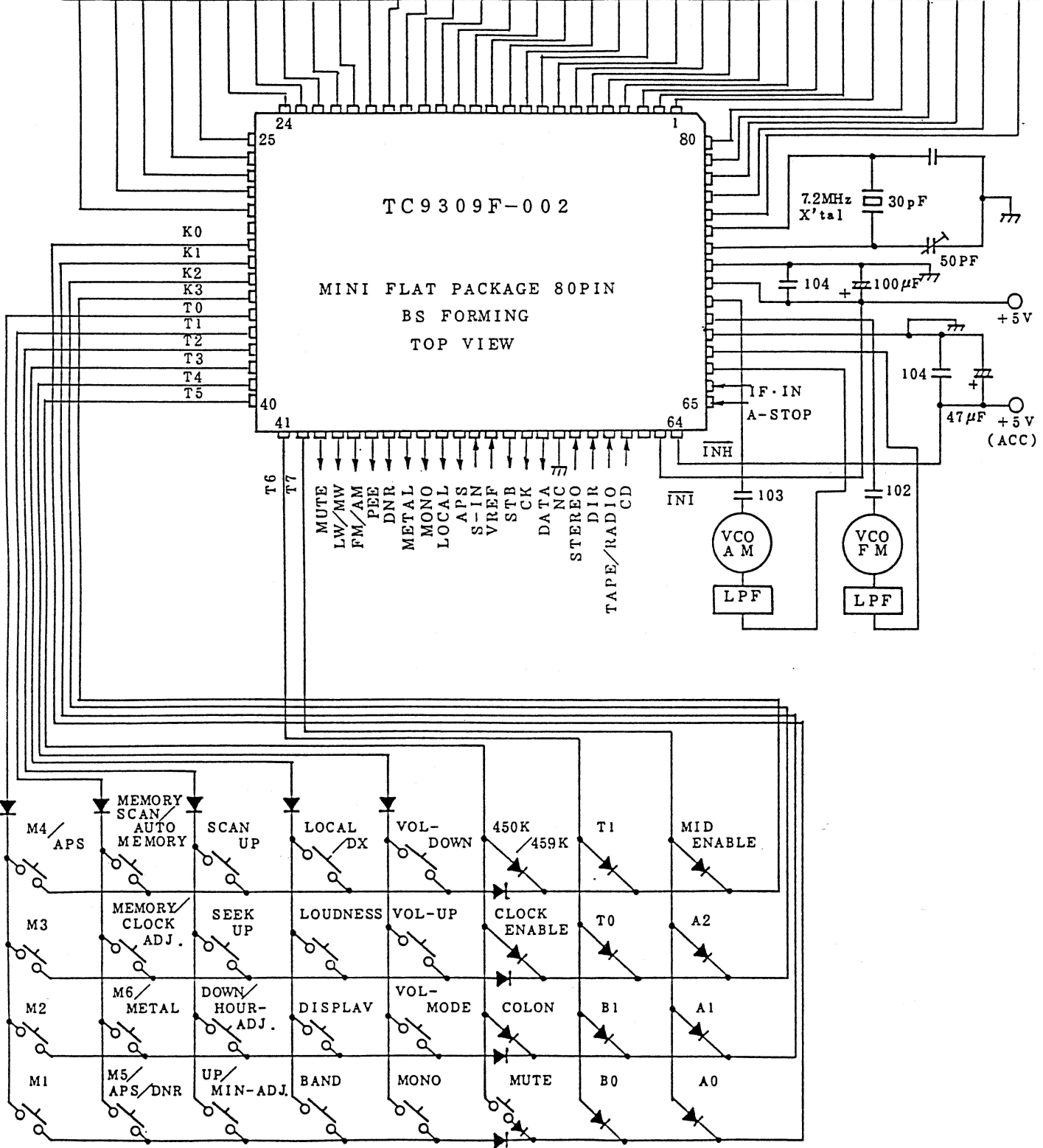
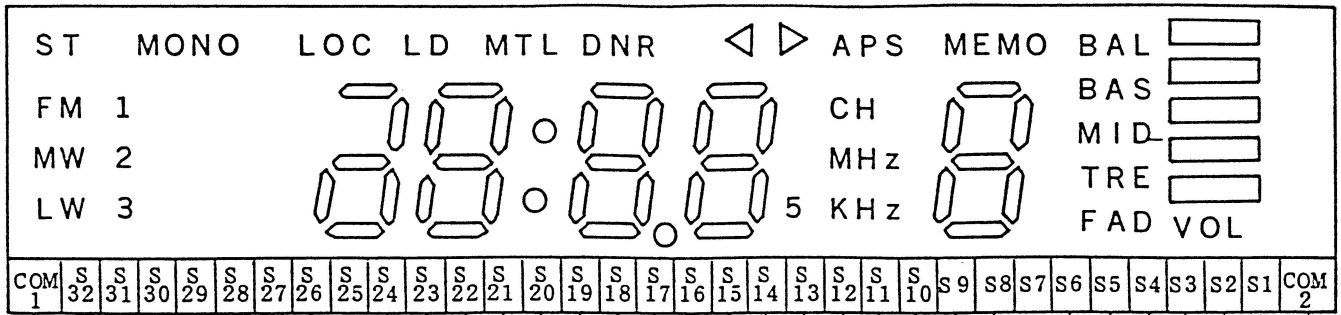
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- . Clock Function
 - . Europe: 24-hour clock
 - . Others: 12-hour clock
- . Function
 - . Radio: stereo indication, STEREO/MONO switching, LOCAL/DX switching.
 - . Tape: METAL/NORMAL switching, Dolby ON/OFF switching, direction indication.
 - . Common: loudness ON/OFF
- . Electronic Volume Function (in combination with TC9222N/F)
 - . Each control of main volume, valance and tone control (3 band type of Bass, Middle and Treble), and indication.
 - . Each volume level indication by 5 points
 - . Built-in mute function
- . Other Function
 - . CD input and indication
 - . PEE sound output
 - . Tracking data

BAND	AREA	M1	M2	M3	M4	M5	UNIT
FM	Europe, S-Africa	87.50	90.10	98.10	106.10	108.00	MHz
	USA 1	87.5	90.1	98.1	106.1	108.1	
	USA 2, Latin America, Australia, Middle & Near East	87.5	90.1	98.1	106.1	108.0	
	Japan	76.0	80.0	83.0	86.0	90.0	
MW	Europe	522	612	999	1404	1620	KHz
	USA 1, 2	520	610	1000	1400	1720	
	Latin America	520	610	1000	1400	1620	
	Australia, Middle & Near East, S-Africa	531	612	999	1404	1602	
	Japan	522	612	999	1404	1629	
LW	Europe	153	164	218	272	281	



TC9309F-006 DIGITAL TUNING SYSTEM

UNDER DEVELOPMENT

OUTLINE OF SYSTEM

TC9309F-006 is CMOS LSI developed for world-wide FM/MW/LW radio of PLL frequency synthesizer type. Prescaler and LCD driver are built in so it can compose a high efficiency 3 band digital tuning system.

RECEIVING BAND

AREA	CODE A2A1A0	BAND	RECEIVING FREQUENCY (Hz)	STEP (Hz)	REFERENCE FREQUENCY (Hz)	IF (Hz)
Europe	000 or 000	FM	87.50~108.00M	50K	25K	+10.70M
		MW	522~1620K	9K	9K	+450K/
		LW	146~281K	1K	1K	+459K
USA 1	010	FM	87.5~108.1M	200K	50K	+10.7M
		AM	520~1720K	10K	10K	+450K
USA 2	011	FM	87.5~108.0M	100K	50K	+10.7M
		AM	520~1720K	10K	10K	+450K
Latin America	100	FM	87.5~108.0M	100K	50K	+10.7M
		AM	520~1620K	5K	5K	+450K
Austral., Middle and Near East	101	FM	87.5~108.0M	100K	50K	+10.7M
		AM	531~1602K	9K	9K	+450K
Japan	110	FM	76.0~90.0M	100K	50K	-10.7M
		AM	522~1629K	9K	9K	+450K
S-Africa	111	FM	87.5~108.00M	50K	25K	-10.70M
		AM	531~1602K	9K	9K	+450K

code=000 is 3 bands (FM/MW/LW), code=001 is 2 bands (FM/MW)

OUTLINE OF FUNCTION

- . Tuning Function
 - . Manual UP/DOWN tuning
 - . Auto-search tuning (SEEK)
 - . Preset Memory scan
 - . Memory Function
 - . FM1/FM2 : 20 stations (max.)
 - . MW : 10 stations (max.)
 - . LW : 10 stations (max.)
 - . Random memory: 30 stations (max.)
 - . Each band has last channel memory.
- total 40 stations (max.)

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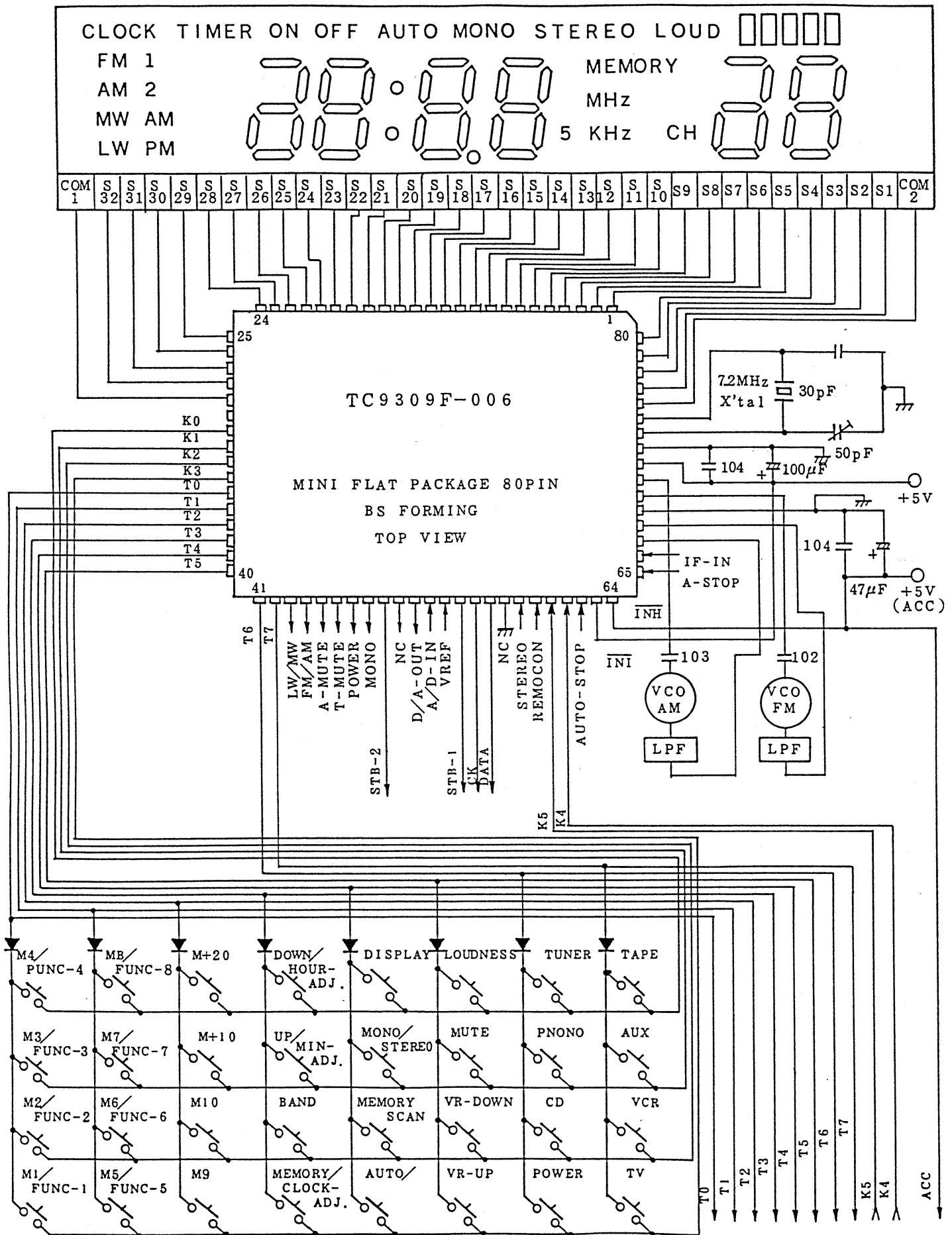
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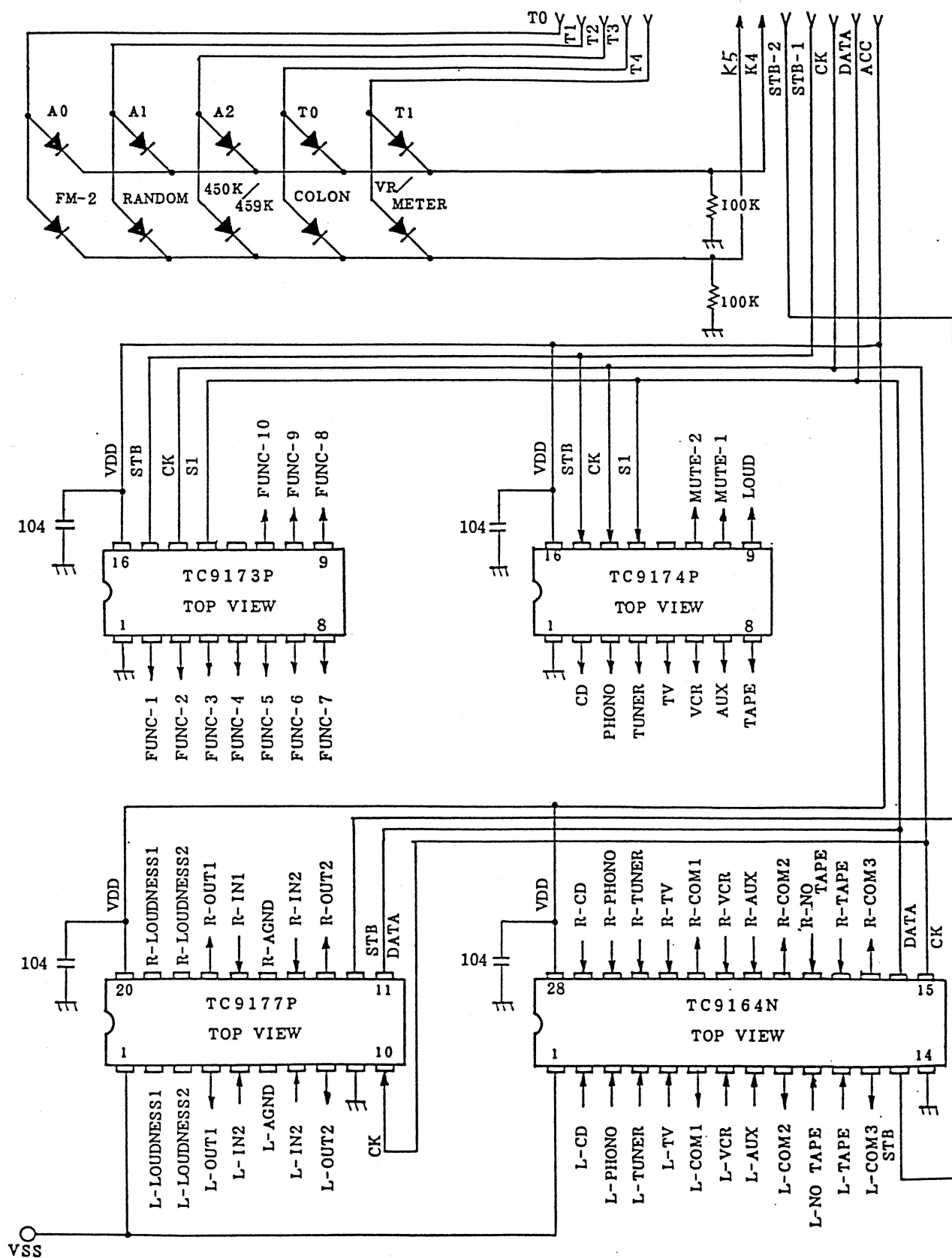
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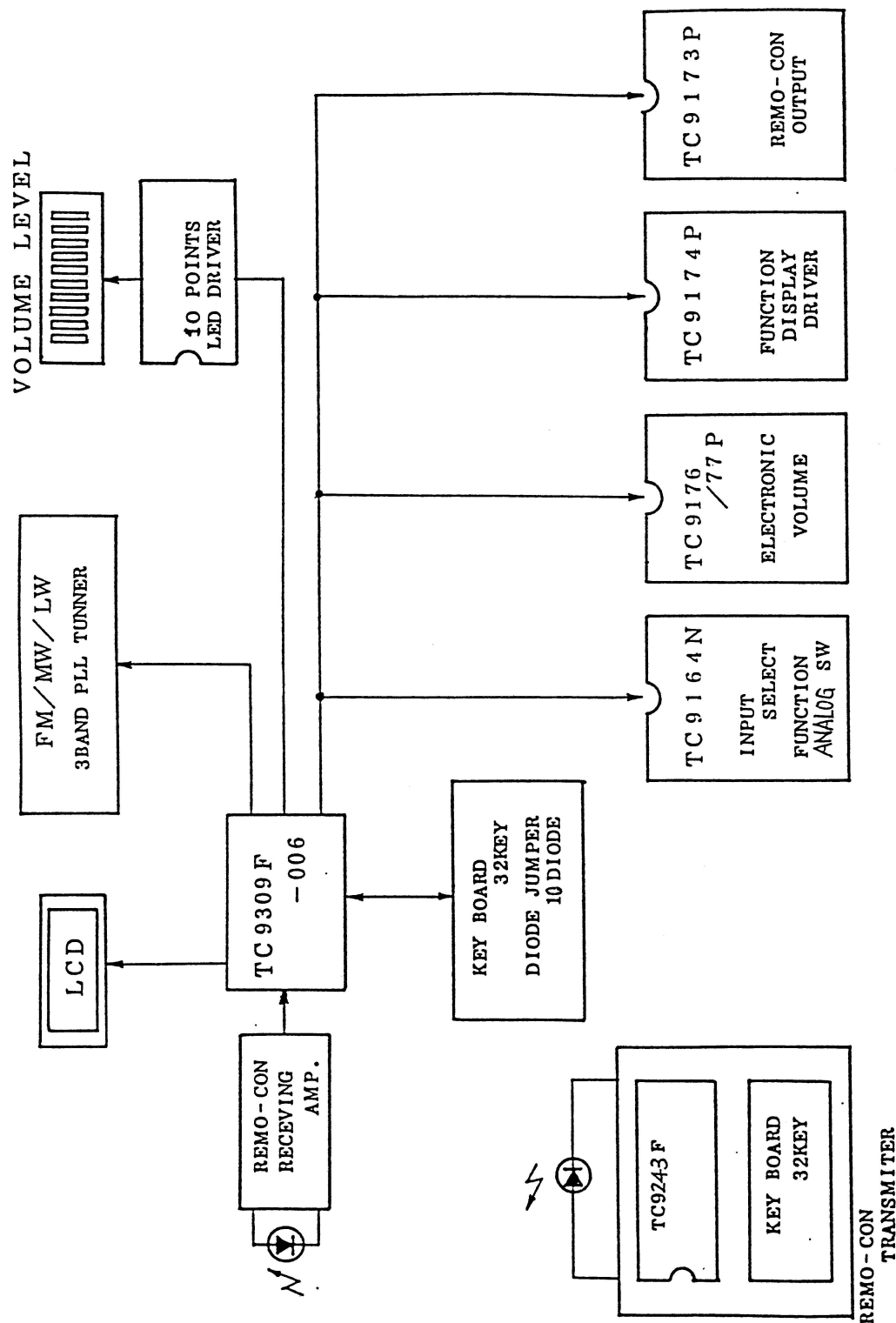
- . Clock Function
 - . Europe: 24-hour clock
 - . Others: 12-hour clock (built-in AM/PM indication)
 - . Timer ON/OFF function (1 time)
- . Audio Control Function
 - . Electronic volume control (TC9176/77P)
 - . Input selector: 6 input+tape monitor (TC9164N)
 - . Function indication (TC9174P)
 - . Electronic volume level indication output (DC output)
 - . Motor volume control output and indication
 - . Loudness control output and indication
 - . -20dB muting function
- . Remotecontrol Decoder Function
 - . 32key remotecontrol decoder (transmission: TC9243 F)
 - . Remotecontrol direct output except tuner mode (TC9173P)
- . Other Function
 - . Signal level indication of receiving station (S-METER)
 - . Stereo indication
 - . Compulsion mono output and indication
 - . Tracking data

BAND	AREA	M1	M2	M3	M4	M5	UNIT
FM	Europe, S-Africa	87.50	90.10	98.10	106.10	108.00	MHz
	USA 1	87.5	90.1	98.1	106.1	108.1	
	USA 2, Latin America, Australia, Middle & Near East	87.5	90.1	98.1	106.1	108.1	
	Japan	76.0	80.0	83.0	86.0	90.0	
MW	Europe	522	612	999	1404	1620	KHz
	USA 1, 2	520	610	1000	1400	1720	
	Latin America	520	610	1000	1400	1620	
	Australia, Middle & Near East, S-Africa	531	612	999	1404	1602	
	Japan	522	612	999	1404	1629	
LW	Europ	146	164	218	272	281	





TC9309F-006 SYSTEM BLOCK DIAGRAM



Single Chip DTS ; TC9304F, TC9309F, TC9319F

※Under Development

		TC9304F	TC9309F	※TC9319F	
Application		Tuner, Car Radio			
Package		QFP-60 *1	QFP-80 *2	QFP-60 *3	
Supply Voltage		5V±10%			
Function		Single chip DTS built-in prescaler, IF counter, PLL and LCD Driver			
ROM		16 bits×1024 Steps	16 bits×3968 Steps	16 bits×2048 Steps	
RAM		4 bits× 128 Words	4 bits× 256 Words	4 bits× 192 Words	
Instruction Set		62	61		
Instruction Excuting Time		44.4 μs	11.1 μs		
Subroutine		1	2		
Key Input Ports		4 (K0~K3)			
Input Ports		1 ($\overline{\text{INH}}$) + (2)			
Output Ports		7 + 1 (MUTE)	12	7 + (1)	
I/O Ports		6	15	7 + (5)	
Display		LCD (1/2 bias, 1/2 duty)			
		Common	2		
		Segment	25	32	25 (max.)
A/D, D/A Converter		4 bit A/D converter	6 bit A/D, D/A converter		
Crystal Resonator		7.2 MHz		3.6/7.2/10.8 MHz	
Reference Frequency		1, 5, 9, 10, 12.5, 25 50, 100 kHz	1, 3.125, 5, 6.25, 9, 10, 12.5, 25, 50,100 kHz		
Programmable Counter		14 bits pulse swallow, 12 bits direct dividing	16 bits, pulse swallow, 12 bits direct dividing		
Prescaler		Built-in 140 MHz 1/15, 1/16 2 modulus type			
IF Counter		450/468/459 kHz, 10.7 MHz only	20 MHz 16 bit general counter	20 MHz 20 bit general counter	
Serial I/F		Built-in (SI/SO/CK/STB)			
Process		CMOS Si-Gate			
OTP (One Time P-ROM) Version		—	TC93P09F	TC93P19F	

Note) Toshiba package code No.

*1: QFP60-P-1414A

*2: QFP80-P-1420A

*3: QFP60-P-1414D

TENTATIVE

Unit : mm

DTS-10

- Single Chip DTS Microcontroller with built-in Prescaler, PLL, LCD Driver and IF Counter.

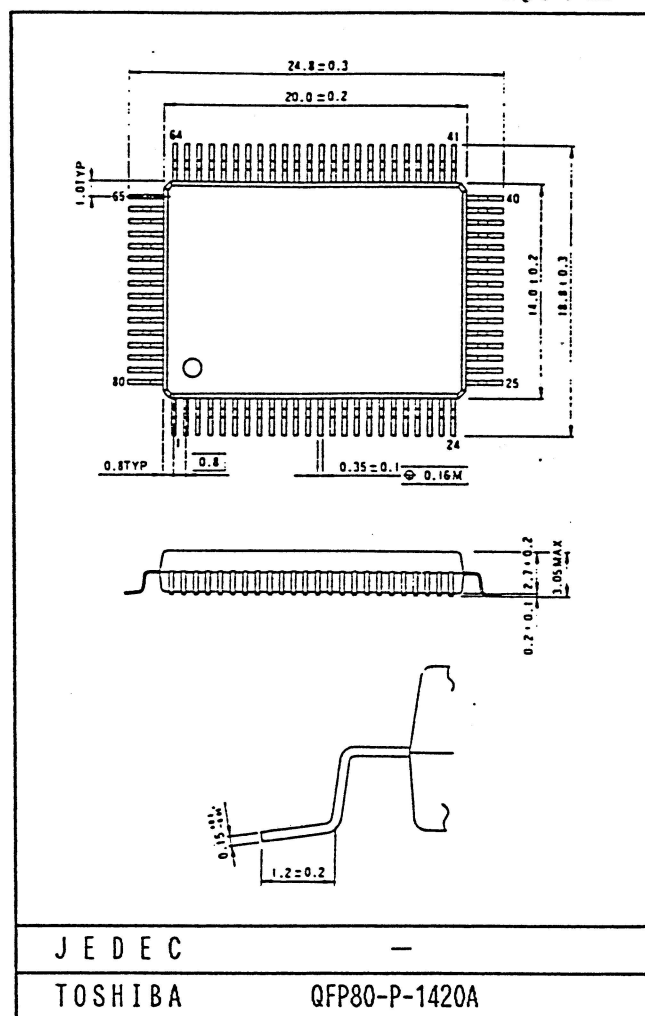
The TC9309F is a 4-bit CMOS microcontroller for single chip digital tuning system with built-in prescaler, PLL and LCD driver.

The CPU has 4 bit parallel addition/subtraction (AI, SI instructions, etc.) logical operation (OR, AN instructions, etc.) multiple bits judgement, comparison instructions (TH, SL instructions, etc.) and time base functions.

The TC9309F is housed in an 80-pin min-flat package and is provided with ample I/O ports and exclusive key input ports which are controlled by powerful I/O instructions (IO, KEY instruction, etc.) and 1/2 duty and 1/2 bias driving ample LCD use exclusive output terminals.

In addition, the TC9309F has built in 2 modulus prescaler, PLL circuit, and IF counter that counts intermediate frequency (IF) in FM and AM bands for detecting broadcasting stations.

Furthermore, the TC9309F has built in serial bus control function (SIO instruction) to powerfully control peripheral ICs, 6-bit A/D converter and D/A converter that are usable for field strength measurement and electronic volume control, and provides with many functions needed for digital tuning system.



Weight : 1.57g

FEATURES

- 4-bit microcontroller single chip digital tuning system
- $5V \pm 10\%$ single power supply, CMOS structure for low power dissipation.
- Built-in prescaler (Max. 140MHz signal is directly input in FM band), PLL and LCD driver (1/2 duty, 1/2 bias, frame frequency: 100Hz, 64 segments).
- Easy back up of data memory (RAM) and various ports (by the \overline{INH} terminal).
- Program memory (ROM): 16 bits \times 3968 steps
- Data memory (RAM) : 4 bits \times 256 words

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- 61 kinds of powerful instructions sets (all single word instructions)
- Instruction execution time 11.1 μ s (7.2MHz crystal connection)
- Abundant add and subtract instructions (Add instruction:12, subtract instruction:12)
- Powerful composite judging instructions (THTR, THFR, THT, TMF instructions, etc.)
- Data transfer at the same row address is possible.
- Register indirect transfer is possible (MVGD, MVGS instructions)
- Powerful 16 general registers (arranged in RAM)
- Stack level:2 levels
- Program memory (ROM) has no conception of page and field, and JUMP and CAL instructions can be freely contained in 3968 steps.

Further, contents of 16 bits data at any address in 1024 steps can be freely referred (DAL instruction)

- Built-in 16-bit general-use IF counter (IF_{IN1}, IF_{IN2})
- Independent frequency input terminals for FM and AM (FM_{IN}, AM_{IN}), 2 phase comparator outputs (D01, D02)
- 10 reference frequencies are programmably selectable (1, 3.125, 5, 6.25, 9, 10, 12.5, 25, 50, 100kHz)
- Pulse swallow system and direct frequency division system are selectable by program according to receiving frequency band.
- IF correction at FM band is possible (Internal port for IF offset)
- Built-in powerful serial bus control function (I/O port-2 terminals are programmatically selectable.)
- Powerful I/O instructions (IO, KEY, SIO instruction, etc.)
- Exclusive key input port (K0~K3), abundant 32 terminals LCD driver.
- IF counter inputs (IF_{IN1}, IF_{IN2}) and input ports (IN1, IN2) are programmatically selectable.
- Max. 34 I/O ports (I/O settable ports:15, output port:12, input port:max.7)
- Clock stop is possible programmatically (at CKSTP instruction:supply current below 10 μ A)
- Built-in 2Hz timer F/F, 10/100Hz internal pulse output (Internal port for time base)
- Locked state of PLL is detectable (Internal port for PLL lock detection)
- Built-in 6-bit A/D and D/A converters (Selectable by selecting I/O port-3 terminals (P3-1~P3-3) programmatically).
- OTP product:TC93P09F

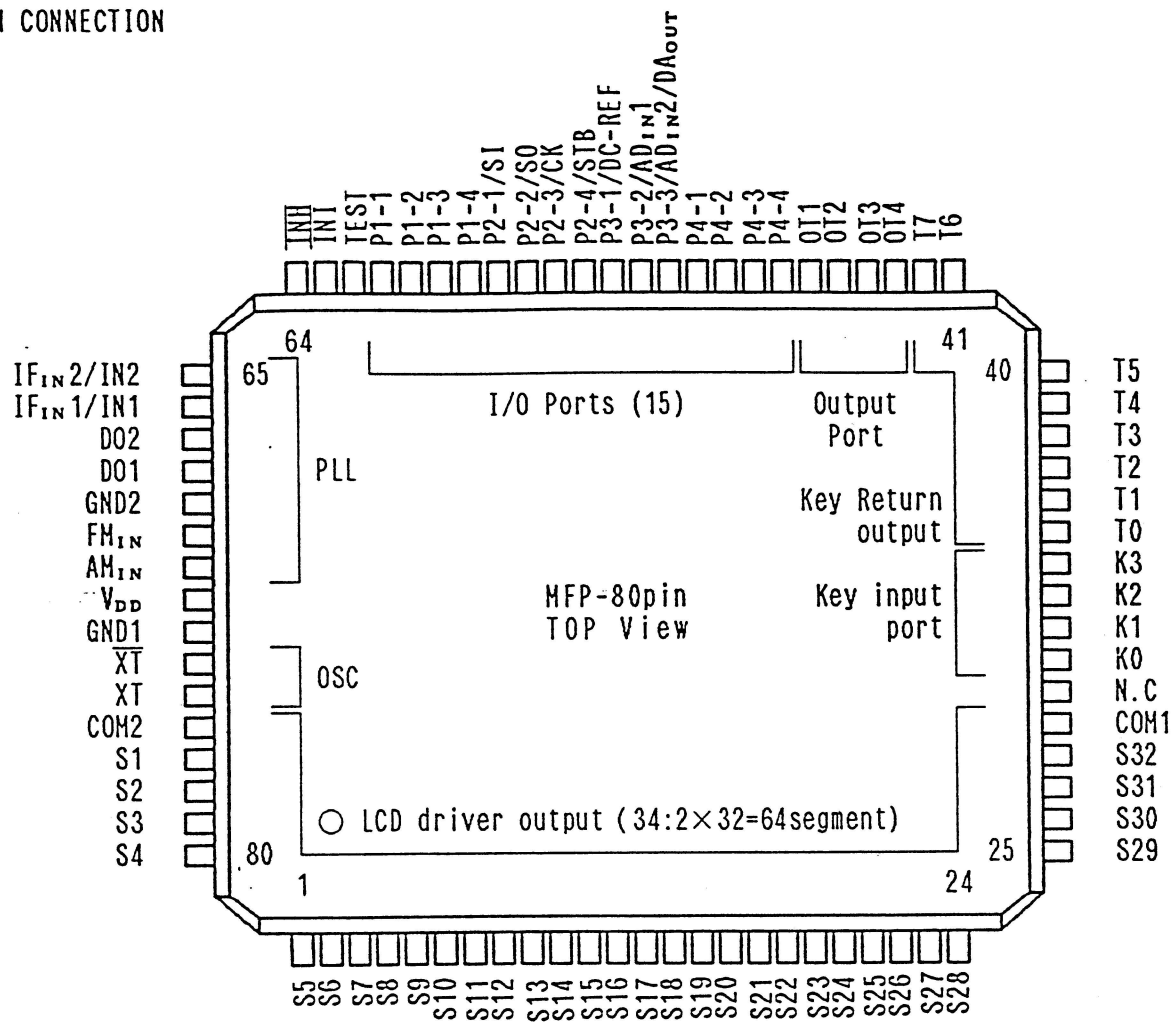
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V _{DD}	-0.3~7.0	V
Input Voltage	V _{IN}	-0.3~V _{DD} +0.3	V
Power Dissipation	P _D	400	mW
Operating Temperature	Topr	-40~85	°C
Storage Temperature	Tstg	-65~150	°C

TC9309F

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PIN CONNECTION



TOP VIEW MINI FP-80PIN

UNDER DEVELOPMENT

DTS-10

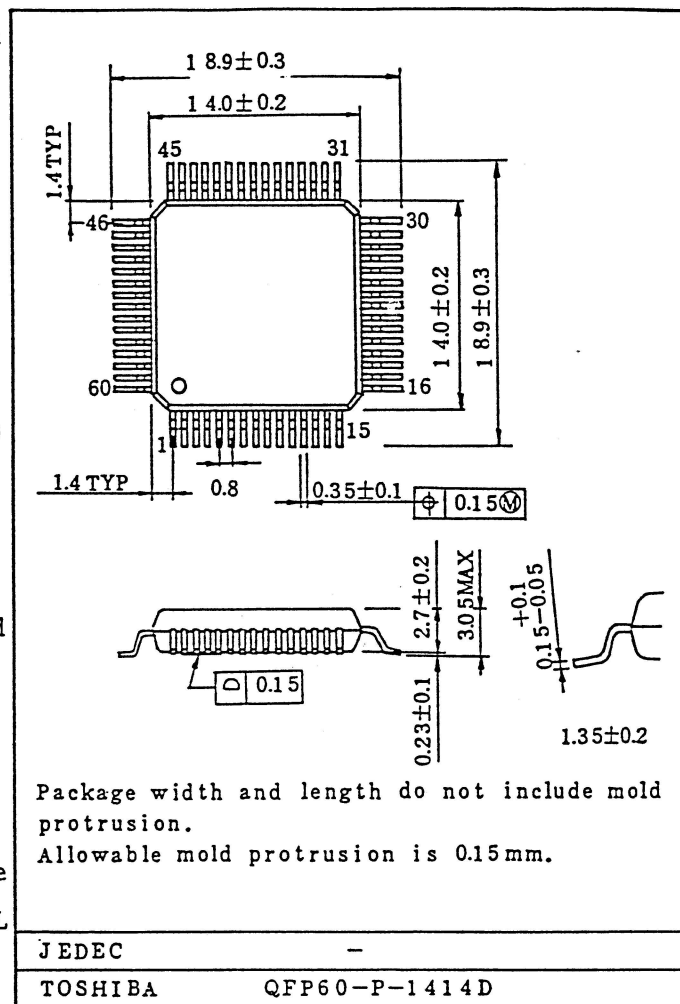
Unit in mm

Single Chip DTS Microcontroller with built-in Prescaler, PLL, LCD Driver and IF Counter.

The TC9319F is a 4-bit CMOS microcontroller for single chip digital tuning system with built-in prescaler, PLL and LCD driver.

The CPU has 4 bit parallel addition/subtraction (AI, SI instructions, etc.) logical operation (OR, AN instructions, etc.) multiple bits judgement, comparison instructions (TM, SL instructions, etc.) and time base functions. The TC9319F is housed in an 60-pin min-flat package and is provided with ample I/O ports and exclusive key input ports which are controlled by powerful I/O instructions (IO, KEY instruction, etc.) and 1/2 duty and 1/2 bias driving ample LCD use exclusive output terminals. In addition, the TC9319F has built in 2 modulus prescaler, PLL circuit, and IF counter that counts intermediate frequency (IF) in FM and AM bands for detecting broadcasting stations.

Furthermore, the TC9319F has built in serial bus control function (SIO instruction) to powerfully control peripheral ICs, 6-bit A/D converter and D/A converter that are usable for field strenght measurement and electronic volume control, and provides with many functions needed for digital tuning system.



Package width and length do not include mold protrusion.
Allowable mold protrusion is 0.15mm.

Weight: 1.10g

FEATURES

- 4-bit microcontroller single chip digital tuning system
- 5V±10% single power supply, CMOS structure for low power dissipation.
- Built-in prescaler (Max. 140MHz signal is directly input in FM band), PLL and LCD driver (1/2 duty, 1/2 bias, frame frequency: 100Hz, 50 segments (max.))

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1988.)

- . Easy back up of data memory (RAM) and various ports (by the $\overline{\text{INH}}$ terminal).
- . Program memory (ROM): 16 bits \times 2048 steps
- . Data memory (RAM): 4 bits \times 192 words

Note Because this product is under development, these specifications are subject to change without notice.

- . 61 kinds of powerful instructions sets (all single word instructions)
- . Instruction execution time 11.1 μ s (3.6MHz or 7.2MHz or 10.8MHz crystal connection)
- . Abundant add and subtract instructions (Add instruction: 12, subtract instruction: 12)
- . Powerful composite judging instructions (TMTR, TMFR, TMT, TMF instructions, etc.)
- . Data transfer at the same row address is possible.
- . Register indirect transfer is possible (MVGD, MVGS instructions)
- . Powerful 16 general registers (arranged in RAM)
- . Stack level: 2 levels
- . Program memory (ROM) has no conception of page and field, and JUMP and CAL instructions can be freely contained in 2048 steps.
Further, contents of 16 bits data at any address in 1024 steps can be freely referred (DAL instruction)
- . Built-in 20-bit general-use IF counter (IFIN1, IFIN2)
- . Independent frequency input terminals for FM and AM (FM_{IN}, AM_{IN}), 2 phase comparator outputs (D01, D02)
- . 3 crystal oscillation frequencies are programmatically selectable. (3.6MHz, 7.2MHz, 10.8MHz)
- . 10 reference frequencies are programmably selectable (1, 3.125, 5, 6.25, 9, 10, 12.5, 25, 50, 100kHz)
- . Pulse swallow system and direct frequency division system are selectable by program according to receiving frequency band.
- . IF correction at FM band is possible (Internal port for IF offset)
- . Built-in powerful serial bus control function (I/O port-2 terminals are programmatically programmatically selectable.)
- . Powerful I/O instructions (IO, KEY, SIO instruction, etc.)
- . Exclusive key input port (K0~K3), abundant 25 (max.) terminals LCD driver.
- . IF counter inputs (IFIN1, IFIN2) and input ports (IN1, IN2) are programmatically selectable.

TC9319F

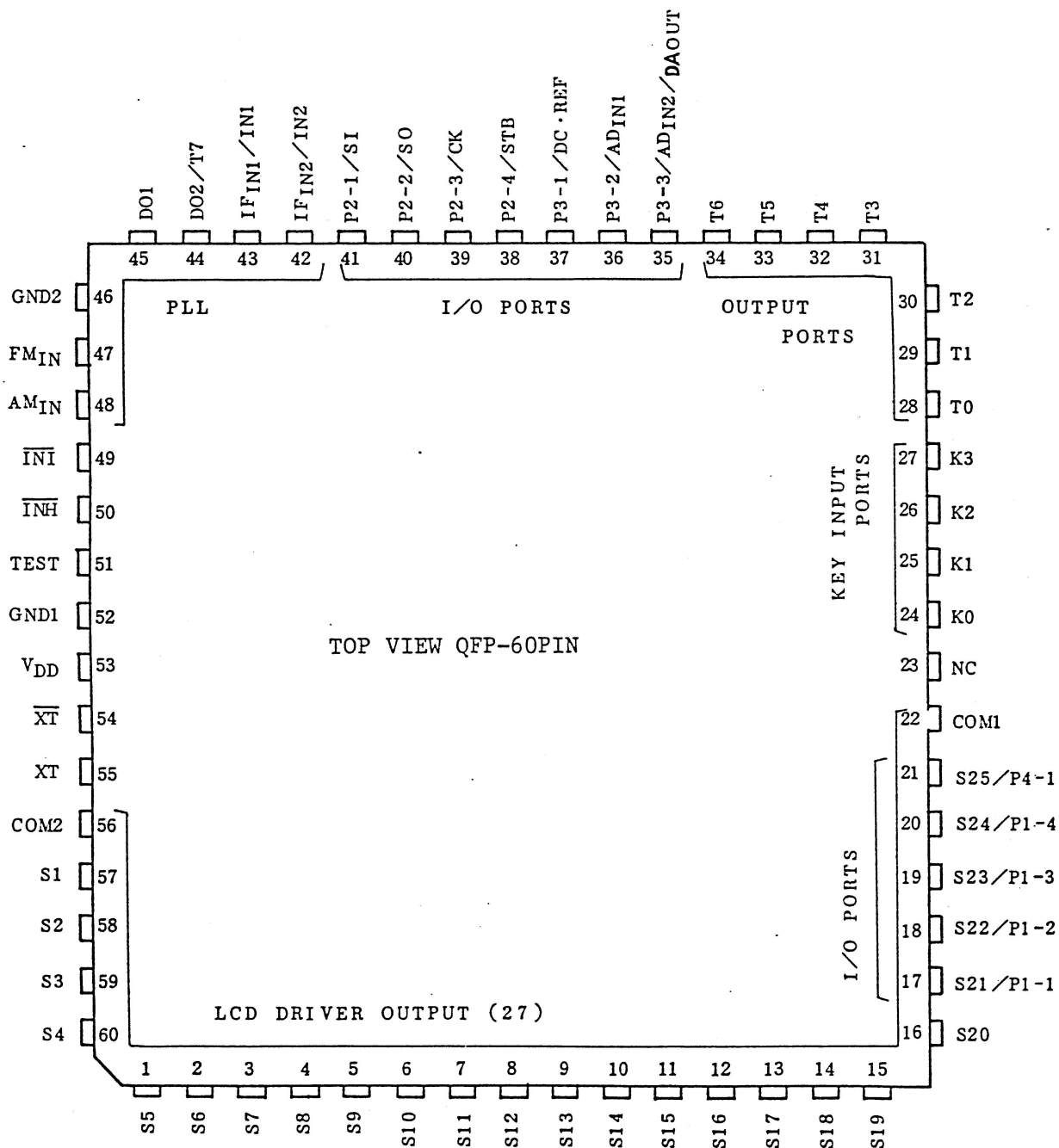
TOSHIBA CORPORATION

- . IF counter inputs (IFIN1, IFIN2) and input ports (IN1, IN2) are programmatically selectable.
- . Max. 27 I/O ports (I/O settable ports: 12 (max.) output port: 8 (max.) input port: 7 (max.))
- . Clock stop is possible programmatically (at CKSTP instruction: supply current below 10 μ A)
- . Built-in 2Hz timer F/F, 10/100Hz internal pulse output (Internal port for time base)
- . Locked state of PLL is detectable (Internal port for PLL lock detection)
- . LCD driver Terminal (S21~S25) and I/O port (P1-1~P1-4, P4-1), phase comparator output (D02) and Output port (T7) are programmatically selectable.
- . Built-in 6-bit A/D and D/A converters (Selectable by selecting I/O port-3 terminals (P3-1~P3-3) programmatically).
- . OTP product: TC93P19F

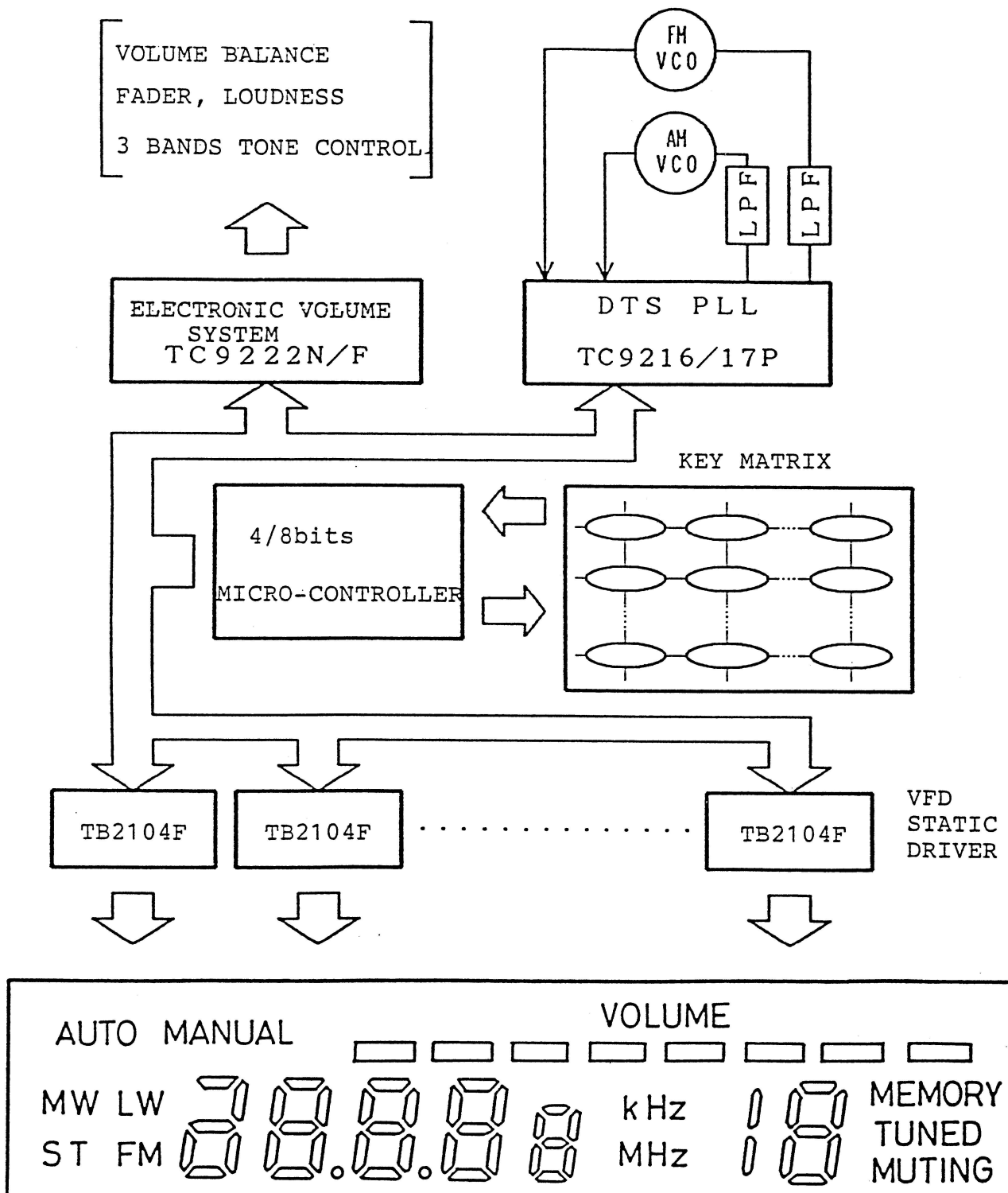
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V _{DD}	-0.3~7.0	V
Input Voltage	V _{IN}	-0.3~V _{DD} +0.3	V
Power Dissipation	P _D	400	mW
Operating Temperature	T _{opr}	-40~85	°C
Storage Temperature	T _{stg}	-65~150	°C

PIN CONNECTION



SERIAL BUS CONTROL SYSTEM



TENTATIVE

Unit in mm

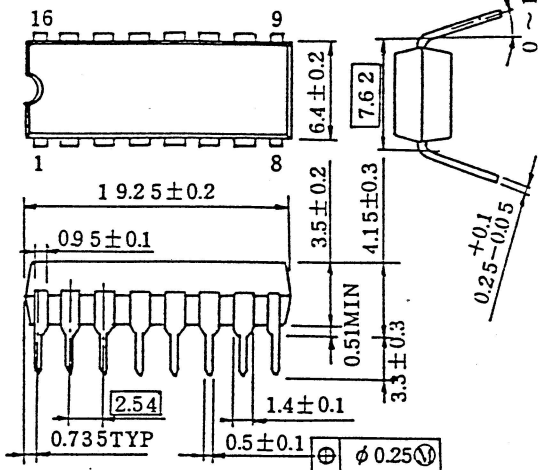
○ HIGH SPEED PLL WITH BUILT-IN PRESCALER FOR DTS

TC9216P/17P is a high speed PLL-LSI with built-in 2-modulus prescaler. Each function is controlled through 3 serial bus lines and high performance digital tuning system can be constituted.

FEATURES

- Suitable for DTS of Hi-Fi tuner and car stereo
- Built-in prescaler, and it can operate 30~140 MHz (2-modulus type) at FM band and 0.5~60 MHz (2-modulus type or direct frequency dividing type) at AM band.
- Built-in 16-bit programmable counter, two parallel outputs phase comparator, crystal oscillator and reference counter.
- Crystal resonator can be used 4.5 MHz or 7.2 MHz.
- 15 kinds of reference frequency can be selected. (when crystal is used 4.5 MHz) (Ref=0.5k, 1k, 2.5k, 3k, 3.125k, 3.90625k, 5k, 6.25k, 7.8125k, 9k, 10k, 12.5k, 25k, 50k, 100 kHz)
- Frequency measurement (HFC_{IN}, LFC_{IN}) of intermediate frequency etc. and periodic measurement (SC_{IN}) of low frequency pilot signal etc. are possible by built-in 16-bit universal type frequency counter. (Note; TC9216P does not have periodic measurement function.)
- Built-in abundant general purpose input/output terminal and usable for control radio circuit part.
- All of function controls are performed through 3 serial bus lines.

TC9216P



Package width and length do not include mold protrusion.
Allowable mold protrusion is 0.15mm.

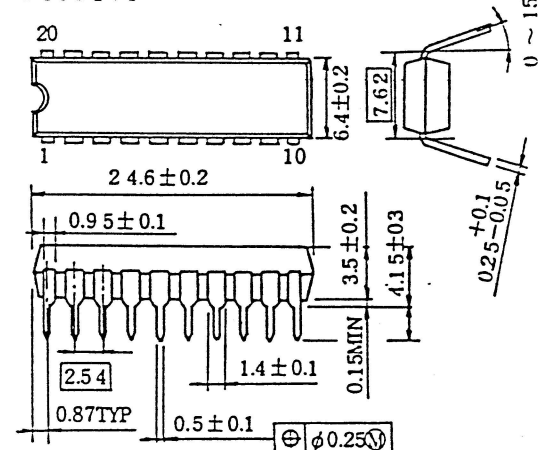
JEDEC

TOSHIBA DIP16-P-300A

Weight: 1.0g

Unit in mm

TC9217P



Package width and length do not include mold protrusion.
Allowable mold protrusion is 0.15mm.

JEDEC

TOSHIBA DIP20-P-300A

Weight: 1.24g

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TC9216, 17P

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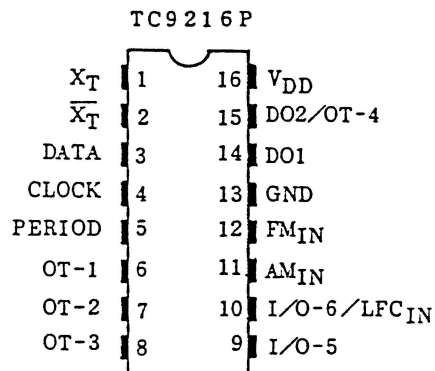
1988.)

- Operating voltage range: $V_{DD}=5.0\pm0.5V$, and it is CMOS structure.
- Package is DIP-16 plastic (TC9216P) and DIP-20 plastic (TC9217P).

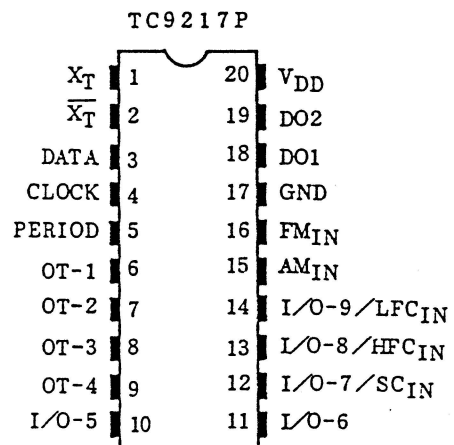
MAXIMUM RATINGS ($T_a=25^\circ C$)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	-0.3~6.0	V
Input Voltage	V_{IN}	-0.3~ $V_{DD} + 0.3$	V
Power Dissipation	P_D	300	mW
Operating Temperature	$T_{opr.}$	-40~85	$^\circ C$
Storage Temperature	T_{stg}	-60~150	$^\circ C$

TERMINAL CONNECTION

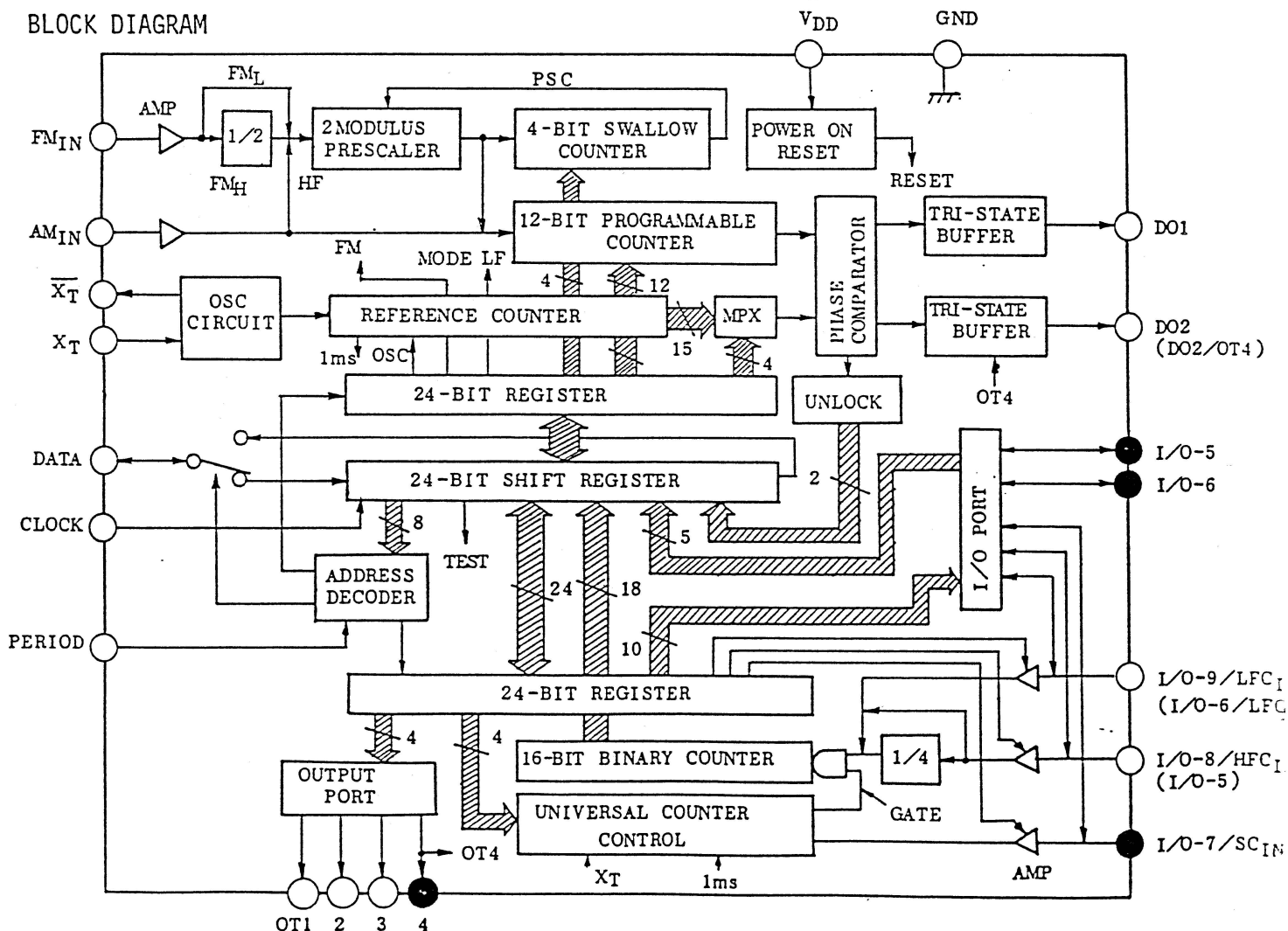


TOP VIEW
DIP-16 PIN



TOP VIEW
DIP-20 PIN

BLOCK DIAGRAM



(Note) ● Mark terminals are not existence in TC9216P.
Terminal name of TC9216P is shown in parentheses.
Others are common terminals.

TENTATIVE

○ SINGLE CHIP ELECTRONIC VOLUME SYSTEM

TC9222N/F is the single chip electronic volume system IC that has been developed for use on car stereos.

This IC is capable of controlling volume (main volume), balance, fader, bass, middle, treble and loudness.

- All volumes are selected and controlled by inputting serial data.

Volume : 0~79dB (1dB/STEP)
Fader : 0~60dB (6 STEPS)
Tone control (bas, middle, treble) : ± 12 dB (2dB/STEP)
Loudness : ON/OFF

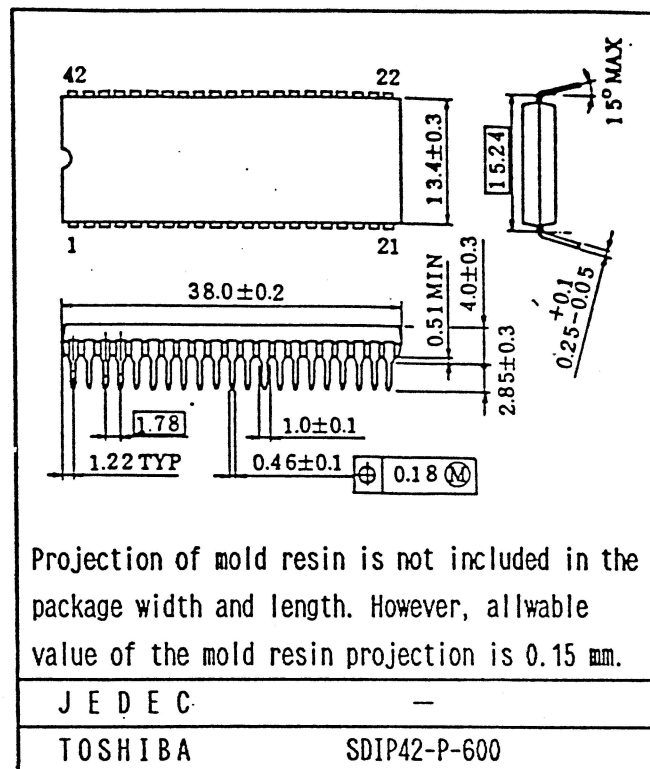
- The logical level of the serial data input terminal has been set at 0-5V and is directly controllable through a 5V system microcomputer.
- The C-MOS structure provides a wide operating supply voltage range and low current consumption.
- This IC is available in two packages ; the shrink DIP 42 pin package (TC9222N) and 44 pin flat package (TC9222F).

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

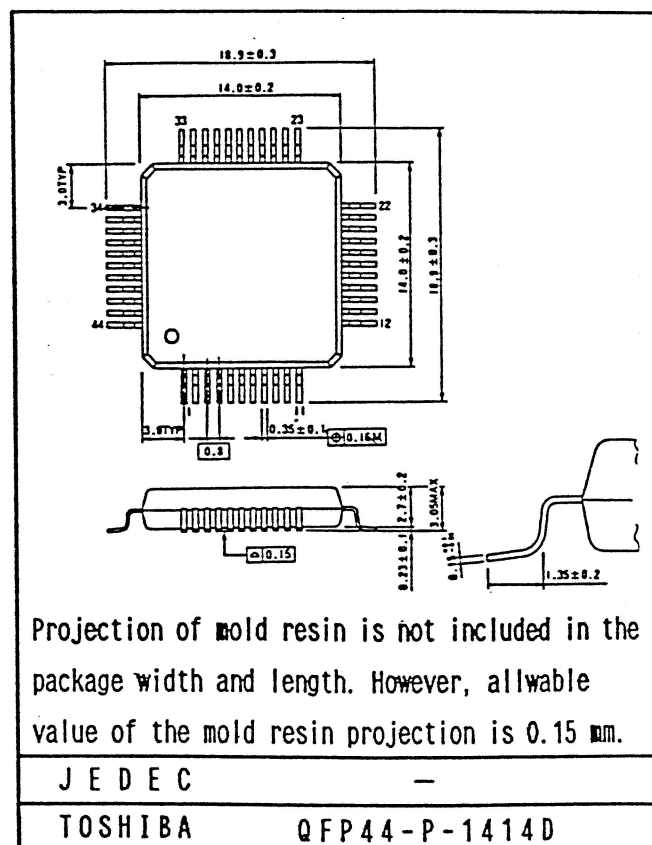
ITEM	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	-0.3 ~ 12	V
Input Voltage	V_{IN}	$V_{SS}-0.3 \sim V_{DD}+0.3$	V
Power Dissipation	P_D	800 (300)	mW
Operating Temperature	T_{OPR}	-40 ~ 85	°C
Storage Temperature	T_{STG}	-65 ~ 150	°C

Current value in () represents RATING for TC9222F.

Unit : mm



Unit : mm



Projection of mold resin is not included in the package width and length. However, allowable value of the mold resin projection is 0.15 mm.

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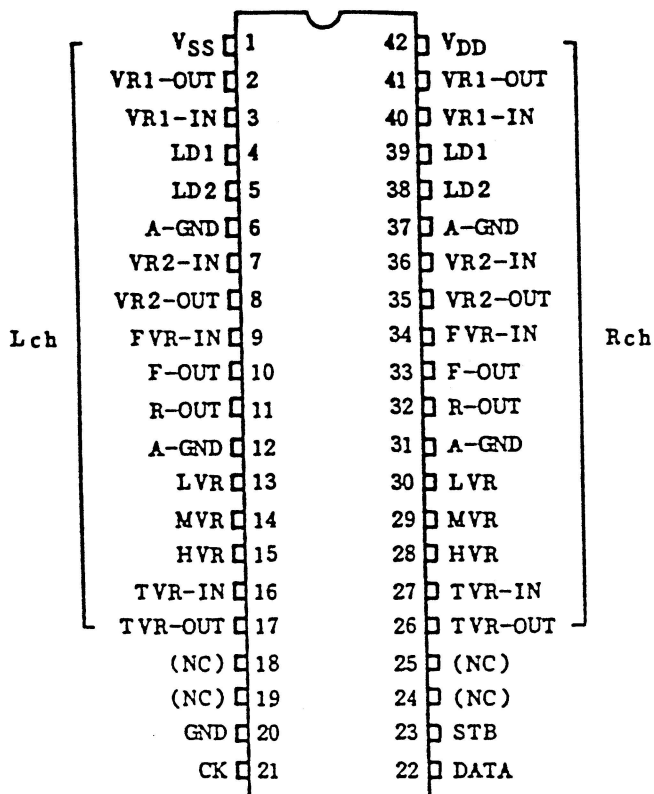
TC9222N

TOSHIBA CORPORATION

PIN CONNECTIONS

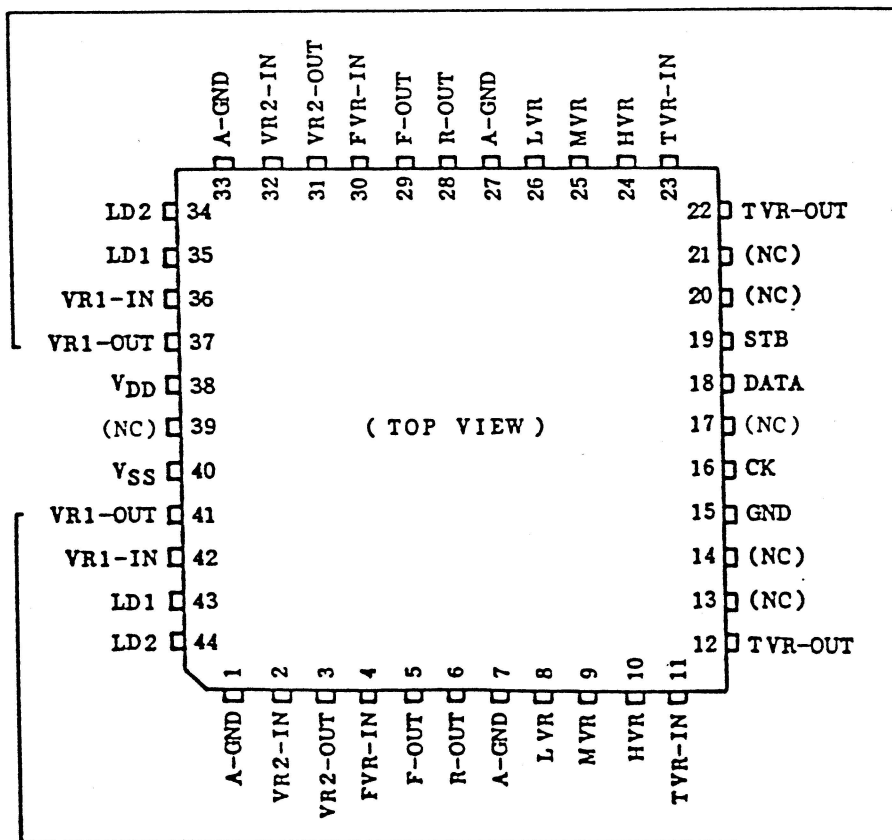
(TOP VIEW)

TC9222N



TC9222F

Rch

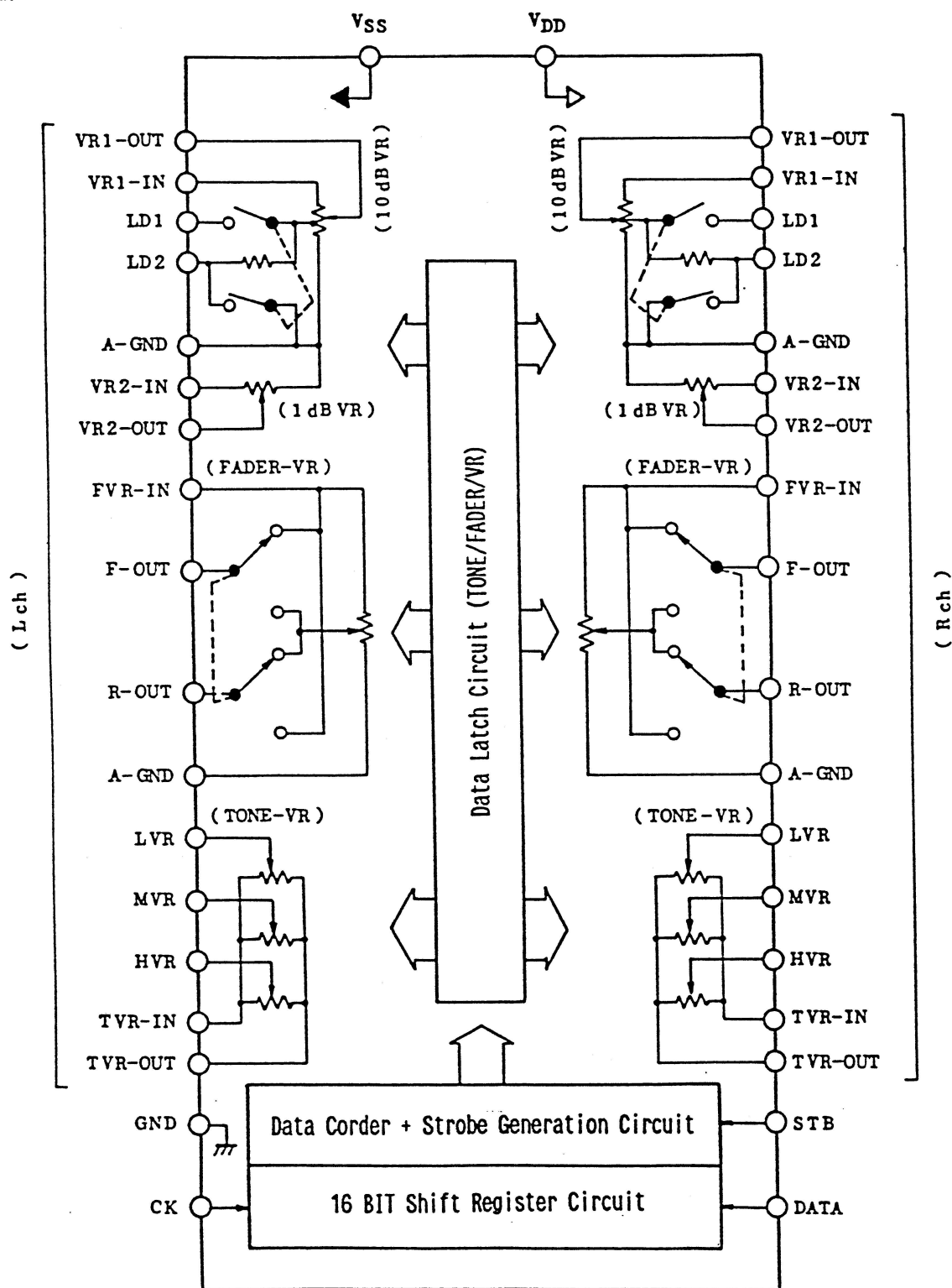


(TOP VIEW)

Lch

TC9222N

BLOCK DIAGRAM



TC9222N

TOSHIBA CORPORATION

TOSHIBA

INTEGRATED CIRCUIT

TECHNICAL DATA

TB2104F

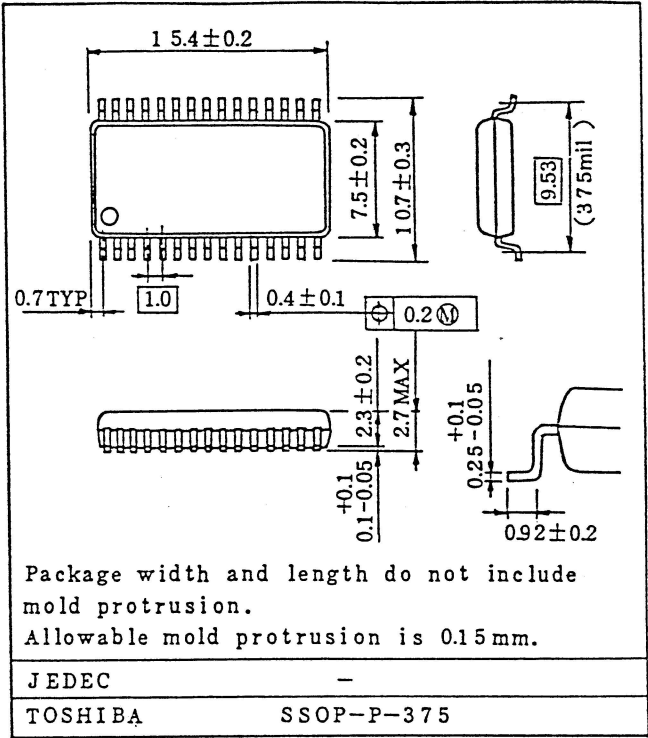
TENTATIVE

OUTLINE

TB2104F is VFD static driver IC developed for display of Hi-Fi Tuner and radio, etc.

FUNCTIONS/FEATURES

- Built-in 20bits (20 segments) VFD drivers. (50V/40mA)
- 20bits serial data control or T-BUS control.
- Mzximum 160 segments (8ICs) display by T-BUS control.
- Bi CMOS Structure.
- Operating Temperature Range Ta=-40~85°C
- Package: SSOP-30



PIN ASSIGNMENT

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V _{DD}	-0.3~+7.0	V
Input Voltage	V _{IN}	-0.3~V _{DD} +0.3	V
Driver Voltage	V _D R	V _D R~+60	V
Driver Current	I _D R	50	mA
Power Dissipation	P _D	800 (Note)	mW
Operating Temperature	T _{opr}	-40~+85	°C
Storage Temperature	T _{stg}	-55~+150	°C

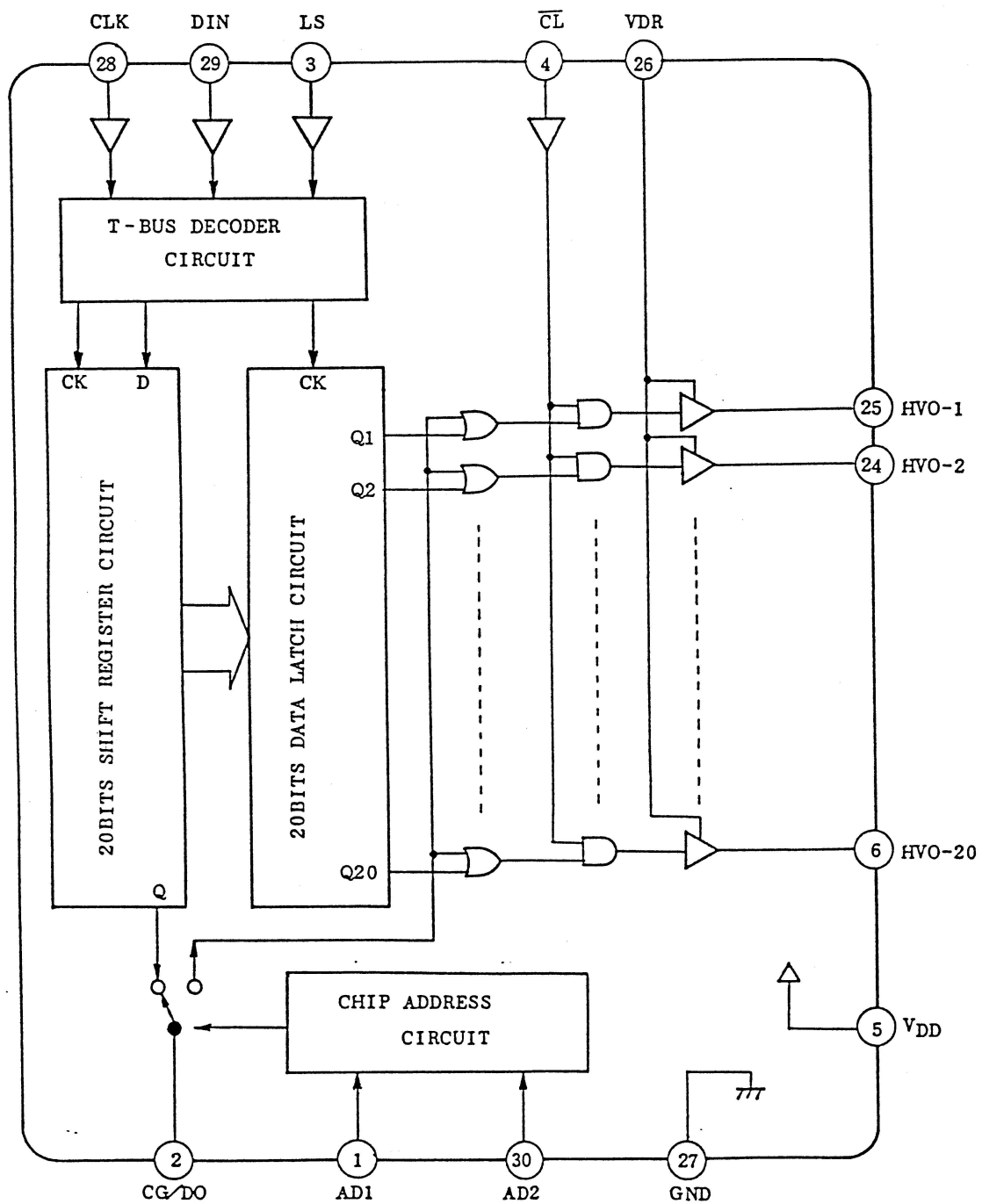
(Note) In case it is used at more than Ta=25°C, it is considered by reducing 6.4 mW each 1°C.

AD1	1	30	AD2
CG/DO	2	29	DIN
LS	3	28	CLK
CL	4	27	GND
VDD	55	26	VDR
HVO-20	6	25	HVO-1
HVO-19	7	24	HVO-2
HVO-18	8	23	HVO-3
HVO-17	9	22	HVO-4
HVO-16	10	21	HVO-5
HVO-15	11	20	HVO-6
HVO-14	12	19	HVO-7
HVO-13	13	18	HVO-8
HVO-12	14	17	HVO-9
HVO-11	15	16	HVO-10

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BLOCK DIAGRAM



TB2104F

TOSHIBA CORPORATION

Audio Digital IC For Serial Data Control

ITEM	PRODUCTS	FEATURE	Vope	Package	Data Format
VOLUME	TC9154AP	Volume Control and Balance Control. ATT=-66dB/2nd step	VDD=12V	DIP-16	Serial 18bits
	TC9156AP	Tone Control. 1 IC/Bass, 1 IC/Treble	VDD=12V	DIP-16	Serial 18bits
	TC9170AP	Graphic Equalizer. 1 IC/1 Band	VDD=12V	DIP-16	Serial 18bits
	TC9176P	Volume Control and Balance Control. Hi-Fi use. -76dB/2dB step	VDD=±15V	DIP-16	Serial 20bits
	TC9177P	Volume, Balance and Loudness Control. Hi-Fi use. -76dB/2dB step	VDD=±15V	DIP-20	Serial 20bits
	TC9184P	Tone Control Bass/Treble.	VDD=±9V	DIP-16	Serial 20bits
	TC9187AN/AF	7 Bands Graphic Equalizer.	VDD=12V	SDIP-42 QFP-44	Serial 12bits
	TC9188N/F	Single chip. Volume, Blance, Tone, Loudness and Fader Control. Car Audio Use	VDD=12V	SDIP-42 QFP-44	Serial 16bits
	TC9194P	Tone Control Bass/Treble.	VDD=±9V	DIP-18	Serial 20bits
	TC9207P	Volume, Balance and Loudness Control. Car Audio use. -75dB/1dB step	VDD=10V	DIP-20	Serial 14bits
	TC9212P	Volume, Balance and Loudness Control. Hi-Fi use. -78dB/1dB step	VDD=±14V	DIP-20	Serial 14bits
	TC9213P	Volume and Balance Control. Hi-Fi use. -78dB/1dB step	VDD=±14V	DIP-16	Serial 14bits
	*TC9222N/F	Single Chip. Volume, Balance, 3Bands Tone, Loudness and Fader control. For Car Audio.	VDD=10V	SDIP-42 QFP-44	Serial 16bits
ANALOG SWITCH	TC9162N	2 contacts×2 circuits, 2 channel	VDD=±15V	SDIP-28	Serial 14bits
	TC9163N	3 contacts×2 circuits, 2 contacts×1 circuits, 2 channel	VDD=±15V	SDIP-28	Serial 14bits
	TC9164N	4 contacts×1 circuits, 2 contacts×2 circuits, 2 channel	VDD=±15V	SDIP-28	Serial 14bits
PLL	TC9181P/F	PLL Frequency, Synthesizer for Mobile and Cordless Telephone.	VDD=5V	DIP-18 SOP-24	Serial 20bits
	*TC9216P	PLL for DTS. fmax=140MHz Built-in IF Counter.	VDD=5V	DIP-16	T-BUS
	*TC9217P	PLL for DTS. fmax=140MHz Built-in IF Counter.	VDD=5V	DIP-20	T-BUS
	*TC9223P/F	PLL Frequency Synthesizer for Mobile and Cordless Telephone.	VDD=5V	DIP-16 SOP-16	Serial 16bits
PRA	TC9311P/F	Mechanism Control LSI.	VDD=3V	DIP-20 SOP-20	Serial 8bits
DRIVER	*TB2104F	20 Segments VFD static driver.	VDD=5V	SSOP-30	T-BUS Serial 20bits

* New Product

** Under Development

Remote Control

Transmission (Infrared Ray Remote Control)

TYPE NO.	TC9011P/F	TC9012F	TC9014F	TC9028P/F	TC9148P
PACKAGE	DIP16-P-300A/ SOP16-P-300	SOP20-P-300	QFP44-P-1414A	DIP20-P-300A/SOP20-P-300	DIP16-P-300A
OPERATING SUPPLY VOLTAGE	2.0~4.0V				
OSCILLATION FREQUENCY	400~500kHz (455Hz TYP.)				
SUBCARRIER FREQUENCY	f _{OSC} /12				
TRANSMISSION FORMAT	TOSHIBA ORIGINAL (FIXED)				
FUNCTION KEY	20	32	128	MAX. 36 (32) *1	18
KEY INPUT PORT	4	4	16	4	6
KEY OUTPUT PORT	5	8	8	3 (INCLUDING HIGH CURRENT OUTPUT)	3
INPUT/OUTPUT PORT	-	-	-	8	-
DOUBLE-DEPRESSING OPERATION *2	2 × 3				
SYSTEM CODE	8 *3	8 *3	256 *3	(8) *1 *3	7
RECEIVING IC	TA8141S				
	TA8141S, TC9149/50P				

ROM	768 × 8BIT
RAM	16 × 4BIT
INSTRUCTION EXECUTION TIME	11μSEC (@ f _{OSC} =455kHz)
INSTRUCTION	44
STACK FOR SUBROUTINE	1 LEVEL
TIMER/COUNTER	. 1 bit READ: 11~14 STAGE (8 stages selection: possible)
	. 4 bit READ: 12~15 STAGE

Receiver (Infrared Ray Remote Control)

TYPE NO.	TC9149P	TC9150P
PACKAGE	DIP16-P-300A	DIP24-P-600
OPERATING SUPPLY VOLTAGE	4.5~5.5V	
OSCILLATION FREQUENCY	27~57kHz	
RECEIVING FORMAT	TOSHIBA ORIGINAL (FIXED)	
FUNCTION SIGNAL OUTPUT	10	18
CONTINUOUS SIGNAL	5	6
SINGLE SHOT SIGNAL	5	10
CYCLIC SIGNAL	0	2
SYSTEM CODE	3	3
TRANSMISSION IC	TC9148P	

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